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NATIONAL DAM INSPECTION PROGRAM. MAPLE LAKE DAM (NDI-PA-00294) --ETC(U)
JAN 79 DACW31-79-C-0015

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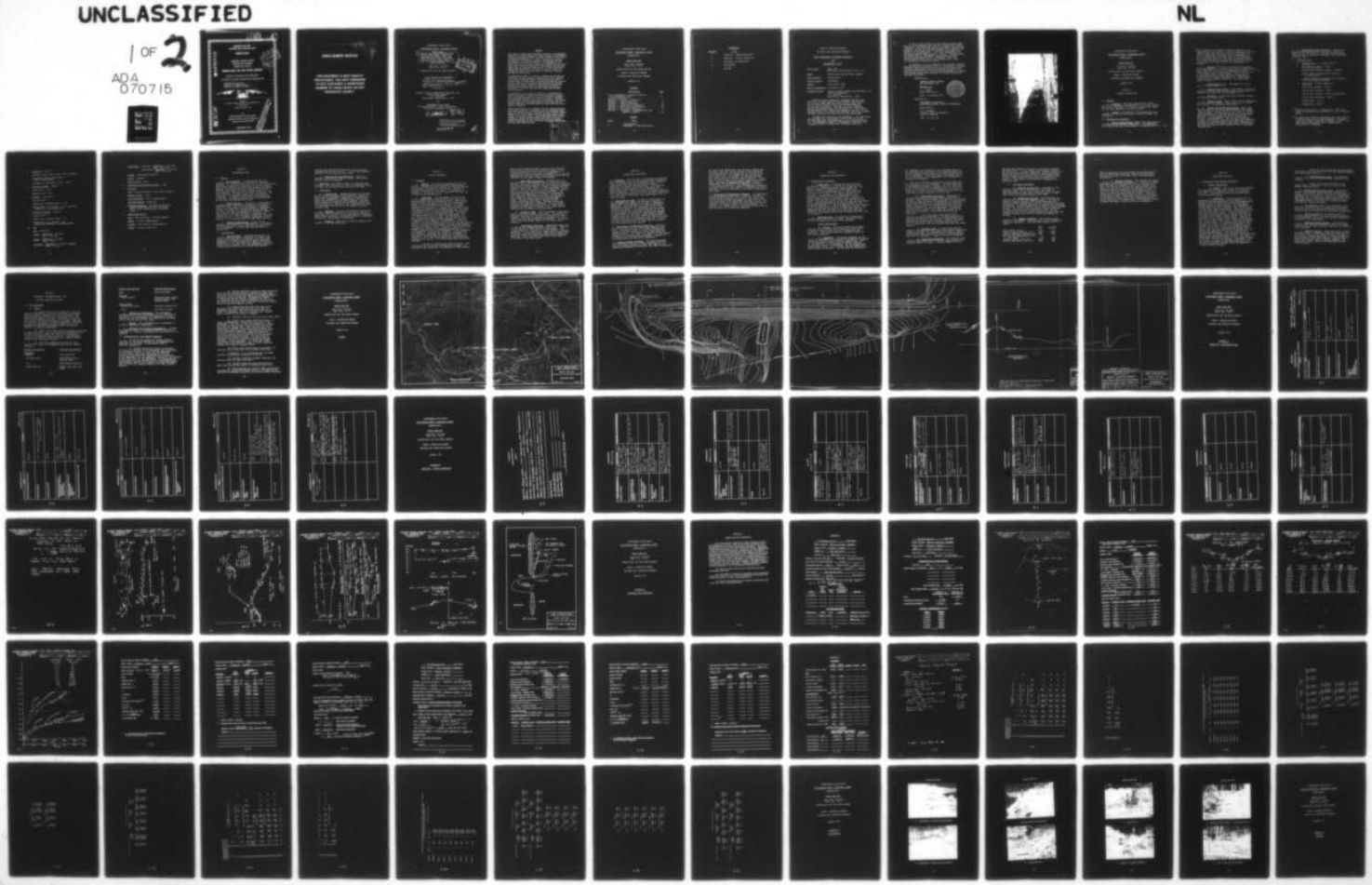

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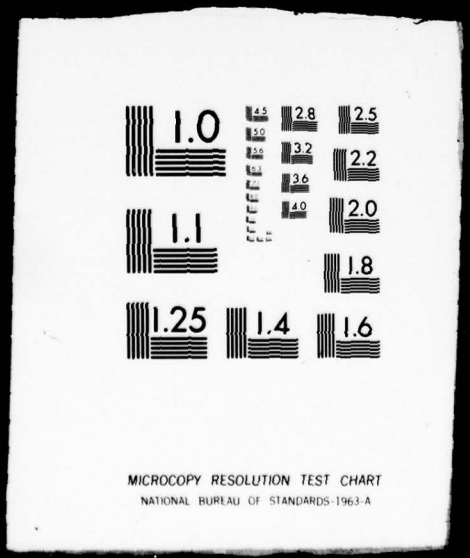

SUSQUEHANNA RIVER BASIN
RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID NO. PA-00294

DER ID NO. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Approved for Public Release
Contract No. DACW31-79-C-0015

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1979

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SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

(6) National Dam Inspection Program. Maple Lake Dam (NDI-PA-ØØ294) (DER-35-42), Susquehanna River Basin, Rattlesnake Creek, Lackawanna County, Pennsylvania. Pennsylvania Gas and Water Company.

MAPLE LAKE DAM

NDI ID No. PA-00294
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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of dam:	Maple Lake NDI ID No. PA-00294/DER ID No. 35-42
Owner:	Pennsylvania Gas and Water Company
State Located:	Pennsylvania
County Located:	Lackawanna
Stream:	Rattlesnake Creek
Date of Inspection:	9 November 1978
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on visual inspection, available records, calculations and past operational performance and according to criteria established for these studies, Maple Lake Dam is rated as unsafe because the spillway capacity is seriously inadequate. The dam is in poor condition and the spillway can pass only 42 percent of the Probable Maximum Flood (PMF) without overtopping of the dam. If the dam should fail, the resulting floodflows would significantly increase tailwater and cause loss of life downstream.

Movement has occurred in the embankment. The downstream toe is bulged and a dry masonry wall at the top of the upstream slope has collapsed with a slide occurring behind it. The embankment cannot be considered to have more than a marginal factor of safety for structural stability.

In view of the concern for the safety of Maple Lake Dam, it is recommended that the Owner immediately perform a hydraulic and hydrologic study to determine the measures necessary to make the spillway hydraulically adequate and perform a structural study to determine the factors of safety for the embankment. It is also recommended that the Owner perform other measures, such as: removing trees and brush from the embankment; monitoring wet areas; installing observation wells; providing a valve pit for the outlet works valve; and ensuring that a plug is available for upstream closure.

In addition, it is recommended that the Owner modify his operational procedures, such as: developing a detailed emergency warning and operation system; providing round-the-clock surveillance of the dam during periods of unusually heavy rains; and activating the emergency operation and warning system when warnings of a storm of major proportions are given.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

A. C. HOOKE
Head, Dam Section

Date: 9 February 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date: 4 Mar 79

MAPLE LAKE DAM

Overview

b

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Maple Lake Dam consists of a homogeneous earthfill embankment. The embankment is 490 feet long and 23 feet high at the maximum section.

The spillway is an irregular excavated channel at the right abutment of the dam. An outlet works with a 24-inch diameter cast-iron pipe and a valve at the downstream toe is located near the middle of the embankment. A dike is located about 500 feet right of the embankment. It is 284 feet long and 3 feet high at maximum section. The various features of the dam are shown on the Plates at the end of the report and on the photographs in Appendix D.

b. Location. The dam is located on Rattlesnake Creek approximately 3.4 miles west of Moscow, Pennsylvania. Maple Lake Dam is shown on USGS Quadrangle, Moscow, Pennsylvania, with coordinates N41° 19'35" and W75° 35'00" in Lackawanna County, Pennsylvania. Nesbitt Dam is located downstream of Maple Lake Dam on Spring Brook 2.9 miles west of Maple Lake Reservoir. Rattlesnake Creek flows into Nesbitt Reservoir. A location map is shown on Plate 1.

c. Size Classification. Intermediate (23 feet high, 1,151 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Maple Lake Dam (Paragraph 5.1c.).

e. Ownership. Pennsylvania Gas and Water Company, Wilkes-Barre, Pennsylvania.

f. Purpose of Dam. Water supply for the communities of Avoca, Duryea, Kingston, Moosic, Old Forge, Pittston, West Pittston, and Wyoming, Pennsylvania.

g. Design and Construction History. Maple Lake Dam was built in 1893 by the Spring Brook Water Company under the general direction of G.F. Anthony, the company superintendent. The dry masonry wall at the top of the upstream embankment slope was constructed between 1893 and 1914. It was reportedly built to reduce wave erosion on the embankment. The dike was constructed in 1923. Between 1927 and 1953, the Owner was repeatedly requested by the Pennsylvania Water Power Commission to increase the spillway capacity and repair the embankment. The owner delayed the work repeatedly, and it was never accomplished.

h. Normal Operational Procedure. The pool is maintained at spillway crest with excess inflow discharging over the spillway. Releases from the outlet works, as well as spillway discharges, flow downstream to Nesbitt Dam.

1.3 Pertinent Data.

a. Drainage Area. 1.0 square miles.[1]

b. Discharge at Damsite. (cfs.)

Maximum known flood at damsite - unknown

Outlet works at maximum pool elevation - 70 (approximate).

Spillway capacity at maximum pool elevation - 500 (existing conditions)

c. Elevation.[2] (Feet above msl.)

Top of dam (design) - 1619.4

Top of dam (Existing) - 1617.4

Top of dike (design) - 1616.3 (approximate)

Top of dike (existing) - 1615.9

Maximum pool - 1617.4

Normal pool - 1613.0

[1] PennDER records show 1.1 square miles. GFCC computed the drainage area and found it to be 1.0 square miles.

[2] An approximate datum for elevations was taken from the reservoir level on the USGS Quadrangle. The datum used on the Owner's drawings is Elevation 100.0. The equivalence is Elevation 1613.0 (USGS) equals Elevation 95.8 (Drawings).

c. Elevation. (cont'd).

Upstream invert outlet works - Not Available

Downstream invert outlet works - 1596.2 (Approximate)

Streambed at centerline of dam - 1596.2

d. Reservoir Length. (Miles.)

Normal pool - 0.50

Maximum pool - 0.55

e. Storage. (Acre-feet.)

Natural Pond - 3

Normal pool (spillway crest) - 657

Maximum pool (top of dam) - 1,151 (existing conditions - excluding dike).

f. Reservoir Surface. (Acres.)

Natural Pond - 3

Normal pool (spillway crest) - 99

Maximum pool (top of dam) - 126 (Existing Conditions - excluding dike).

g. Dam.

Type - Earthfill

Length - Embankment - 490 feet
Dike - 284 feet

Height - Embankment - 23 feet
Dike - 3 feet

Top Width - Embankment - 15 feet. (design)
Dike - 10 feet.

Side Slopes - Upstream - Embankment - 1V on 2H
Dike - 1V on 3H
Downstream - Embankment - 1V on 2H
Dike - 1V on 3H

Zoning - Homogeneous earthfill.

Cutoff - Unknown.

Grout Curtain - None.

h. Diversion and Regulating Tunnel. None.

i. Spillway.

Type - Excavated channel with control section.

Length of Weir - None.

Crest Elevation - 1613.0 (Approximate)

Upstream Channel - Reservoir.

Downstream Channel - Variable bottom width channel which deflects left to stream about 70 feet downstream of the outlet works.

j. Regulating Outlets.

Type - Cast-iron-pipe - 24-inch diameter.

Length - 70 feet (approximate)

Closure - Gate valve at downstream toe.

Access - To valve stem only.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. No engineering data was available for review for the structure as originally designed. In a study performed in 1914 by the Pennsylvania Water Supply Commission, an account of design concepts, geology, construction materials and methods, and design features was prepared for the components of the dam from interviews with the Owner, visual inspection, and other sources. The data in the report is limited. The 1914 study also included analyses for hydrology and hydraulics. A summary of the results of the analyses is on file. No engineering data for the construction of the dike was available for review.

b. Design Features. The project is described in Paragraph 1.2g. The various features of the dam are shown on Plate 2 and on the Photographs in Appendix D. Plate 2 was drawn from a survey apparently performed in 1953. It cannot be considered a design drawing. The Owner did not have any drawings for the dike. Survey data acquired for this inspection is presented in Appendix B. An attempt was made to duplicate the datum shown on Plate 2. As no permanent benchmarks could be located, it is uncertain that the same datum was used.

c. Design Considerations. In one of the periodic inspections by the Commonwealth, the inspector expressed the belief that a core wall was constructed in the embankment. No other data was available to confirm this.

2.2 Construction.

a. Data Available. Construction data for the original structure that is available for review, consists of the information contained in the 1914 report prepared by the Pennsylvania Water Supply Commission. Information in the 1914 report is limited; it consists solely of the statement that "The embankments are said to have been constructed of selected clay material

resting upon foundations from which loose rock and vegetable matter were removed." No data was available pertinent to construction of the dike.

b. Construction Considerations. Since the available construction data is limited, construction methods cannot be assessed.

2.3 Operation. No formal records of operation were reviewed. The Owner did not report any problems having occurred over the operational history of the dam.

2.4 Evaluation.

a. Availability. Engineering data was provided by the Division of Dams and Encroachments, Bureau of Water Quality Management, Department of Environmental Resources, Commonwealth of Pennsylvania, and by the Owner, Pennsylvania Gas and Water Company. The Owner made available an engineer for information during the visual inspection. The Owner also researched his files for additional information at the request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data are very limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The overall appearance of the dam is poor. Deficiencies were observed as noted below. A sketch of the dam with the location of some deficiencies is presented in Appendix B on Plate B-1. Survey information acquired for this report is summarized in Appendix B. On the day of the inspection, the pool was 1.4 feet below spillway crest.

b. Embankment. The embankment is in poor condition. Heavy brush and small trees cover the top of the embankment and the downstream slope. Newly fallen leaves covered this area on the day of the inspection. Details of the embankment were obscured. The downstream slope was 1V on 1.8H, as noted in the survey information in Appendix B. Bulges that are about 1 foot high extend along part of the downstream toe. As noted in paragraph 1.2g, a vertical dry masonry wall was constructed at the top of the upstream slope. This wall is bulged severely and collapsed in many areas. The soil behind this wall has slid. The combination of wall movement and earth movement extends over at least 50 percent of the length of the embankment. There is evidence of recent movement; some areas of soil at the top of the slide area have bare soil, with no grass growing therein. Because of the movement, the existing topwidth of the dam is about 4 feet. A sketch of the section where movement has occurred is presented in Appendix B. A profile along the top of the embankment is also presented in Appendix B. The profile is uneven. No design data was available concerning the design top elevation. A discussion of the design top elevation is presented in Section 5. Wet areas and standing water were observed downstream of the toe. All these areas have poor natural drainage.

The dike is covered with trees and brush. The downstream toe of the dike terminates at a swamp. On the day of the inspection, the elevation of the standing

water in the swamp was higher than the pool elevation. The elevation of the top of the dike is about 1 foot below the elevation of the top of the embankment. A profile and a section are shown in Appendix B. A positive drainage path from the swamp to Rattlesnake Creek was not observed, as the swamp is heavily overgrown.

c. Appurtenant Structures. The spillway is in poor condition. The spillway control section is poorly defined. The timber spillway weir is rotted and collapsed. The spillway outlet channel is severely eroded, especially along the right bank. There is also some debris in the channel. The outlet works is in good condition; however, most of the outlet works could not be viewed. The operating platform was constructed with dry masonry, which abut the embankment on 3 sides. On the day of the inspection, the outlet works valve was partially open; water was being released into Rattlesnake Creek. The end of the pipe is beneath the dry masonry operating floor ledge. The end of the pipe could not be inspected or measured. The valve stem protrudes through the operating floor. There did not appear to be any means of access to the valve without removing the dry masonry operating floor.

d. Reservoir Area. About 50 percent of the watershed is very flat, swampy, and wooded. This portion is owned and controlled by the Pennsylvania Gas and Water Company. The other 50 percent is rolling hills, with farm fields and sparse suburban development. The access road to the dam extends along the left shore of the reservoir.

e. Downstream Conditions. Immediately downstream of the dam, the stream has steep wooded banks. There is a minor amount of small debris in the channel. The stream flows for 4.0 miles in a steep channel to Nesbitt Reservoir. In the above reach, there are two homes that would definitely be flooded by failure flows from Maple Lake Dam. There are other homes that would probably be flooded in the above reach.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at spillway crest, Elevation 1613.0, with excess inflow discharging over the spillway and into Rattlesnake Creek. Rattlesnake Creek flows into Spring Brook, at Nesbitt Reservoir 4.0 stream miles downstream. A 24-inch diameter cast-iron water supply line discharges into Rattlesnake Creek, which flows into Spring Brook at Nesbitt Reservoir. Since streamflow is usually augmented only when Nesbitt Reservoir is below spillway crest elevation, the valve on the Maple Lake water supply line is usually closed.

4.2 Maintenance of Dam. The dam is visited daily by two caretakers who record the reservoir elevation. Weekly reports are mailed to the Owner's Engineering Department. This information is used by the Owner's Engineering Department for regulating flows in the distribution system. The caretakers are also responsible for observing the general condition of the dam and appurtenant structures and reporting any changes or deficiencies to the Owner's Engineering Department. A Pennsylvania Gas and Water Company engineer makes a formal inspection of the dam each year, and the records are filed and used for determining priority of repairs. Informal inspections are also made when the engineer is on the site for other reasons.

4.3 Maintenance of Operating Facilities. Access to the valve, other than the valve stem, appeared impossible. Apparently, there is no regular maintenance schedule, but maintenance of items is performed when deemed necessary. In response to the dam inspection program of the previous year, the Owner is in the process of modifying his maintenance procedures. Details of the program have not been fully formulated.

4.4 Warning Systems in Effect. The Owner furnished the inspection team with a verbal description of the chain of command diagram for Maple Lake Dam and of a generalized emergency notification list that is applicable

for all of the Pennsylvania Gas and Water Company dams. The Owner said that during periods of heavy rainfall, available personnel are dispatched to the dams to observe conditions. All company vehicles are equipped with radios, and the personnel can communicate with each other and with a central control facility. Evaluation of risk is made by the Owner's Engineering Department. The Owner's Engineering Department is also responsible for notification of emergency conditions to the local authorities. Detailed emergency operational procedures have not been formally established for Maple Lake Dam, but are as directed by the Owner's Engineering Department.

4.5 Evaluation Of Operational Adequacy. The operational procedures appear satisfactory. However, in order to ensure proper operation, the valve on the outlet pipe should be fully opened and closed at least once a year. The maintenance of the embankment and dike is poor. The procedures used by the Owner for inspecting the dam are adequate, but needed repairs have not been made. In general, the warning system is adequate, but it would be more effective if it were more detailed.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. No design data was available for review. During 1914, a report on the dam was prepared by the Pennsylvania Water Supply Commission. The report estimated the maximum spillway capacity at 330 cfs. This was determined with a 5-foot head and a top width of 60 feet at the control section of the spillway. The estimate of discharge capacity was qualified as being difficult to determine. The discharge capacity used in the Report is not entirely compatible with the above-noted 5-foot head and 60-foot top width. A discharge capacity of 500 cfs, with the embankment at its existing elevation as discussed hereafter, was estimated (Appendix C). The 1914 Report notes the existence of the low area where the dike is presently located. The Report states that the area is 2.5 feet below the top of embankment and that the area would act as an auxiliary spillway. No discharge capacity was estimated for this area in the Report.

b. Experience Data. No hydraulic or hydrologic problems were reported by the Owner. He stated that no records of maximum pool levels were available.

c. Visual Observations

(1) General. The visual inspection of Maple Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydraulics and hydrology. These observations are evaluated herein for the various features.

(2) Embankment. The design elevation of the top of the embankment was selected by estimating the design elevation from the existing profile (Appendix B). Most of the embankment is lower than the design elevation. At the right end of the embankment, the top elevation is substantially lower. In this area, the top slopes downward towards the spillway. The existing top elevation of

the embankment was selected as that elevation where it was estimated that discharges in the spillway would overtop the spillway channel and start flowing along the toe of the embankment. This would create an erosion hazard. Due to the nature of the topography, this elevation is difficult to estimate.

The top of the dike is more than 1 foot lower than the existing top of the embankment. The dike would act as an emergency spillway. However, the brush and trees on the dike would retard discharges over it. Since the outlet of the swamp at the downstream toe could not be observed, it is not known if a backwater effect from the swamp would reduce discharges over the dike.

(3) Appurtenant Structures. Conditions at the spillway make its discharge capacity difficult to estimate. The discharge capacity is limited by the erosion potential along the toe of the embankment, as noted herein. The erosion observed at the right bank of the spillway channel does not threaten the embankment and is not considered a deficiency. The erosion along the left bank could eventually threaten the embankment. The debris observed in the channel could cause overtopping of the banks and allow water to flow along the toe of the embankment.

The outlet works pipe extends under pressure through the embankment. The Owner stated that various size plugs and an in-house diving capability are available to plug the line upstream. However, the Owner did not know if the correct size plug was available. If it is available, then the closure facilities are deemed adequate.

(4) Reservoir Area. No conditions were observed in the reservoir area that might present significant hazard to the dam. The assessment of the dam is based on existing conditions and the effects of future development are not considered. Access to the dam is adequate.

(5) Downstream Conditions. No conditions were observed downstream from the dam that might present significant hazard to the dam. A Phase I Report for the

National Dam Inspection Program was previously prepared for Nesbitt Dam. In that report, the spillway of Nesbitt Dam was rated as seriously inadequate. Because failure of Maple Lake Dam could cause failure of Nesbitt Dam during certain conditions and because there are residences downstream of Maple Lake Dam that would be flooded by its failure, a high hazard classification is warranted for Maple Lake Dam.

d. Overtopping Potential

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the spillway design flood (SDF) for the size (Intermediate) and hazard potential (High) of Maple Lake Dam is the probable maximum flood (PMF).

(2) Description of Model. The watershed was modelled with the HEC-1DB computer program. The HEC-1DB computer program computes a PMF runoff hydrograph and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. The PMF inflow to Maple Lake was routed through the dam. The outflow from the dam was routed downstream to Nesbitt Reservoir and through Nesbitt Dam. It was assumed that no runoff occured downstream of Maple Lake Dam. Identical methods were used for various percentages of the PMF.

(3) Summary of Results. The following table summarizes the results. Selected parts of the program output are in Appendix C. The total PMF rainfall is 24.9 inches.

	PMF	1/2 PMF
Total Runoff (inches)	22.8	11.4
Inflow to Maple Lake Dam (cfs)	3656	1828
Outflow from Maple Lake Dam (cfs)	2411	578
Depth of Overtopping Maple Lake Dam (feet)	1.69	0.44
Inflow to Nesbitt Dam (cfs)	2351	566
Outflow from Nesbitt Dam (cfs)	1822	387

Nesbitt Dam would not be overtopped by the PMF occuring over the Maple Lake watershed. The existing spillway can pass 42 percent of the PMF without the overtopping of the dike.

(4) Spillway Adequacy. The criteria for rating a spillway is presented in Appendix C. The dike at Maple Lake Dam would be overtopped by 0.44 foot during the 1/2 PMF. The dike was assumed to fail over a 70-foot long breach 0.1 hour after it would be overtopped by 0.2 foot. The breach was only assumed to extend down 3.4 feet. A breach of this size will raise the stream depth by 2.8 feet at a dwelling located near the stream. This would significantly increase the hazard to loss of life downstream from the dam. Nesbitt Dam would not be overtopped by the failure of Maple Lake Dam, considering that no other inflow occurs to Nesbitt Dam. The spillway capacity of Maple Lake Dam is rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Maple Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. Brush and trees on the embankment slopes or at the toe are undesirable. The failure of the dry masonry wall and the accompanied embankment slide at the top of the dam along the upstream slope is of major concern. The embankment sliding behind the wall indicates that the failure of the wall was a shear type failure. The slide surface is relatively fresh in some areas indicating that movement was relatively recent. It was not possible to determine if the failure was a shallow shear failure or a deep-seated shear failure, however, the failure appeared to be a shallow shear failure. Because of the slide in some areas, the top width of the embankment is only about 4 feet wide. Where the dry masonry wall failed, there is no upstream slope protection at the top of the dam. A review of photographs in the PennDER files shows that the top of dam was approximately level in 1914. Subsequent photographs and Plate 2 show that failure of the dry masonry wall and accompanied embankment failure has been occurring over an extended period. The downstream slope is steeper than the design slope listed in the Pennsylvania Water Supply Commission Report of 1914. The steep downstream slope may be related to the bulges observed at the toe. It was not possible to determine if the wet areas and seepage at the downstream toe of the slope were related to seepage from the embankment or to poor surface drainage.

Brush and trees on the dike are undesirable. The uneven top elevations on the dike are probably caused by poor construction practice.

(3) Appurtenant Structures. No conditions relevant to structural stability were observed at the spillway.

Access to the pipe and valve of the outlet works is impossible without removing the dry masonry operating floor.

b. Design and Construction Data. No record of design data or stability analysis was available for review. Furthermore, almost nothing is known about the embankment or its foundation. Analysis of the embankment stability is beyond the scope of this study. Also, sufficient data on the engineering properties of the embankment material would have to be acquired before the analysis could be performed.

The embankment cannot be considered to have more than a marginal factor or safety for structural stability due to the observed deficiencies and the uncertain nature and condition of its interior composition.

c. Operating Records. No formal records of operation were reviewed. Evidence of some instability on the embankment was noted in the periodic inspections performed by the Commonwealth.

d. Postconstruction Changes. As noted herein, there is sufficient information available on all modifications made to Maple Lake Dam, such that its stability can be assessed.

e. Seismic Stability. Maple Lake Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. However, since there are no formal static stability analyses, the theoretical seismic stability of Maple Lake Dam cannot be assessed.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND

PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety.

(1) Based on the visual inspection, available records, calculations, and past operational performance, Maple Lake Dam is judged to be in poor condition. The existing spillway will pass only 42 percent of the PMF without overtopping of the dam. The failure of the dam will cause a significant increase in tailwater downstream. The spillway is rated as seriously inadequate. According to criteria established for these studies by OCE, the dam must be classified as unsafe because the spillway capacity is seriously inadequate.

(2) There is no formal stability analysis available for Maple Lake Dam. There is evidence of problems such as failure of the dry masonry wall and its retained fill at the top of dam and bulges at the toe. The embankment cannot be considered to have more than a marginal factor of safety for structural stability.

(3) The visual inspection resulted in some deficiencies, which are summarized below for the various features.

Feature and Location	Observed Deficiencies
Embankment:	
Slopes	Trees and brush
Upstream slope	Wall failure and resultant slide
Top	Below design elevation
Downstream toe	Bulges, wet areas, and brush

Feature and Location	Observed Deficiencies
Dike	Trees and brush
Spillway:	
Outlet channel	Brush and trees, poorly defined section, and erosion hazard
Outlet Works:	
Closure facilities	Uncertain availability
Valve	No access to valve

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. In view of the concern for safety of Maple Lake Dam, the following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to determine the extent of movement of the embankment and to ascertain the structural factors of safety for the embankment. In this regard, additional investigations will be necessary to determine the engineering soil properties of the embankment and the foundation, as well as the location of the water level in the embankment. The latter may be accomplished with the observation wells recommended below. Take remedial measures as required to restore the embankment to either its original template or a more suitable template.

(2) Perform additional studies to more accurately ascertain the spillway capacity required for Maple Lake Dam as well as the nature and extent of mitigation measures required to make the spillway hydraulically adequate and to remove the erosion hazard. Designing the dike to be overtopped may be a suitable approach, but the spillway should be provided with a weir and the spillway channel should be protected against erosion.

(3) Remove brush and trees that are in the spillway outlet channel and that are on or near the embankment and dike. When the brush and trees are removed, the embankment should be inspected on a regular basis to check for wet areas or seepage.

(4) Provide a valve pit for the outlet works valve.

(5) Install six or more observation wells, or other instrumentation, downstream of the axis of the embankment. One well, or other instrumentation, should be located in the vicinity of each of both the two wet areas and the seepage area. The others should be at appropriate locations to determine general water levels in the downstream embankment. Data collected from observation wells or other instrumentation should be utilized in evaluating the stability of the structures and assessing piping potential. The area along the downstream toe should be graded to provide positive drainage. Continue to observe wet areas and seepage downstream of the embankment. If conditions worsen, appropriate action should be taken to control apparent seepage with properly designed drains.

(6) Ensure that proper plugs are available for upstream closure facilities on the outlet works pipe.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Maple Lake Dam.

(2) Provide round-the-clock surveillance of Maple Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

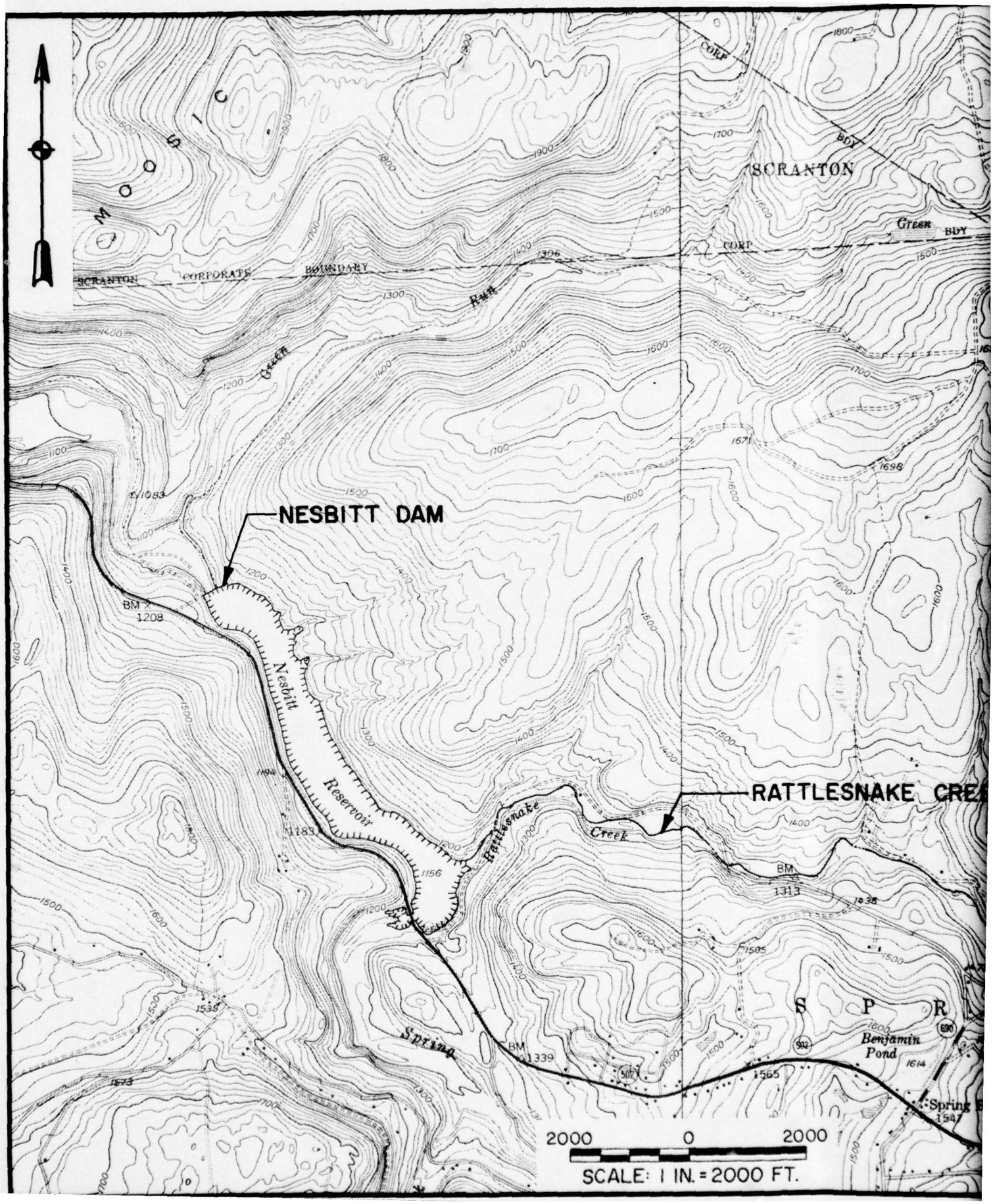
PENNSYLVANIA GAS AND WATER COMPANY

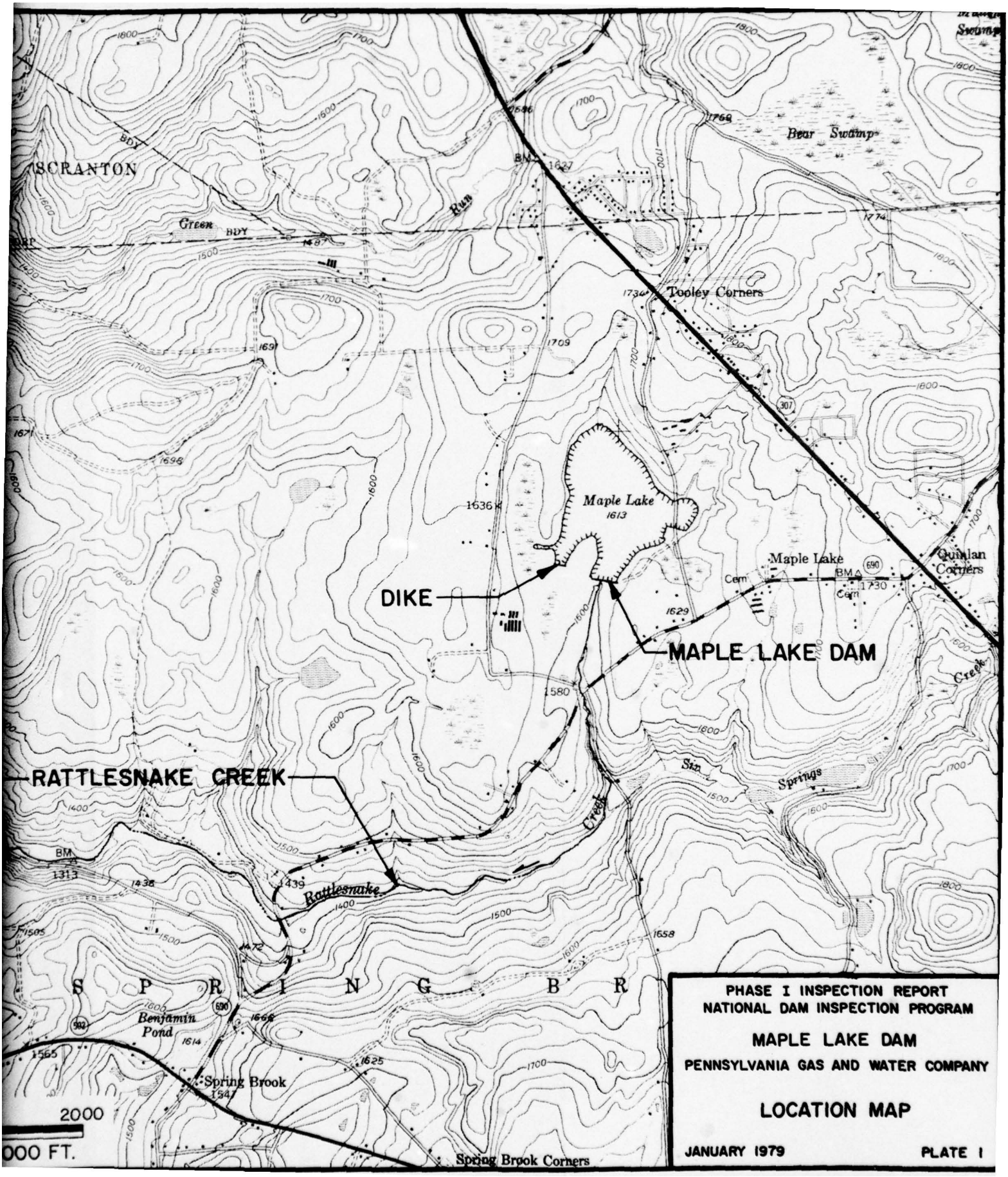
PHASE I INSPECTION REPORT

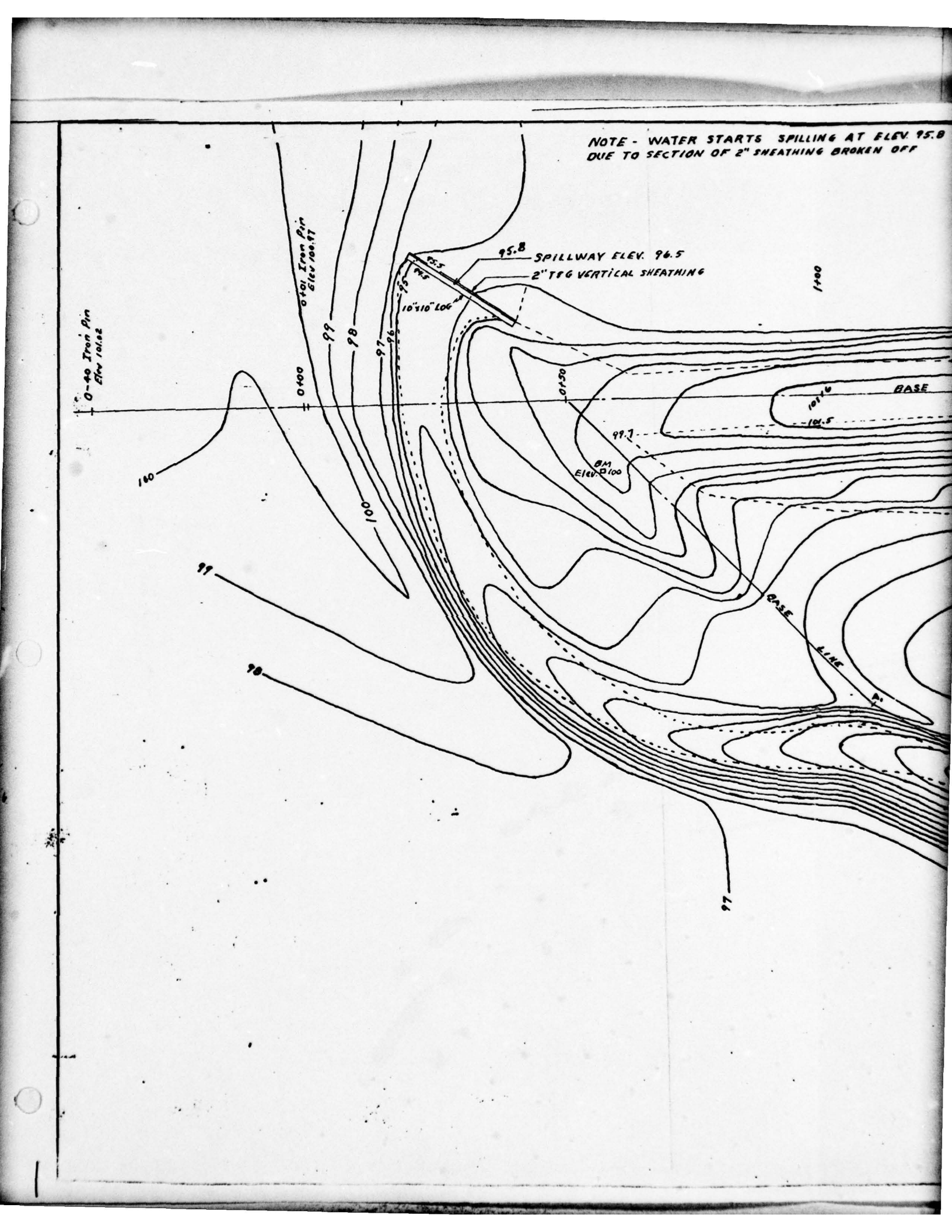
NATIONAL DAM INSPECTION PROGRAM

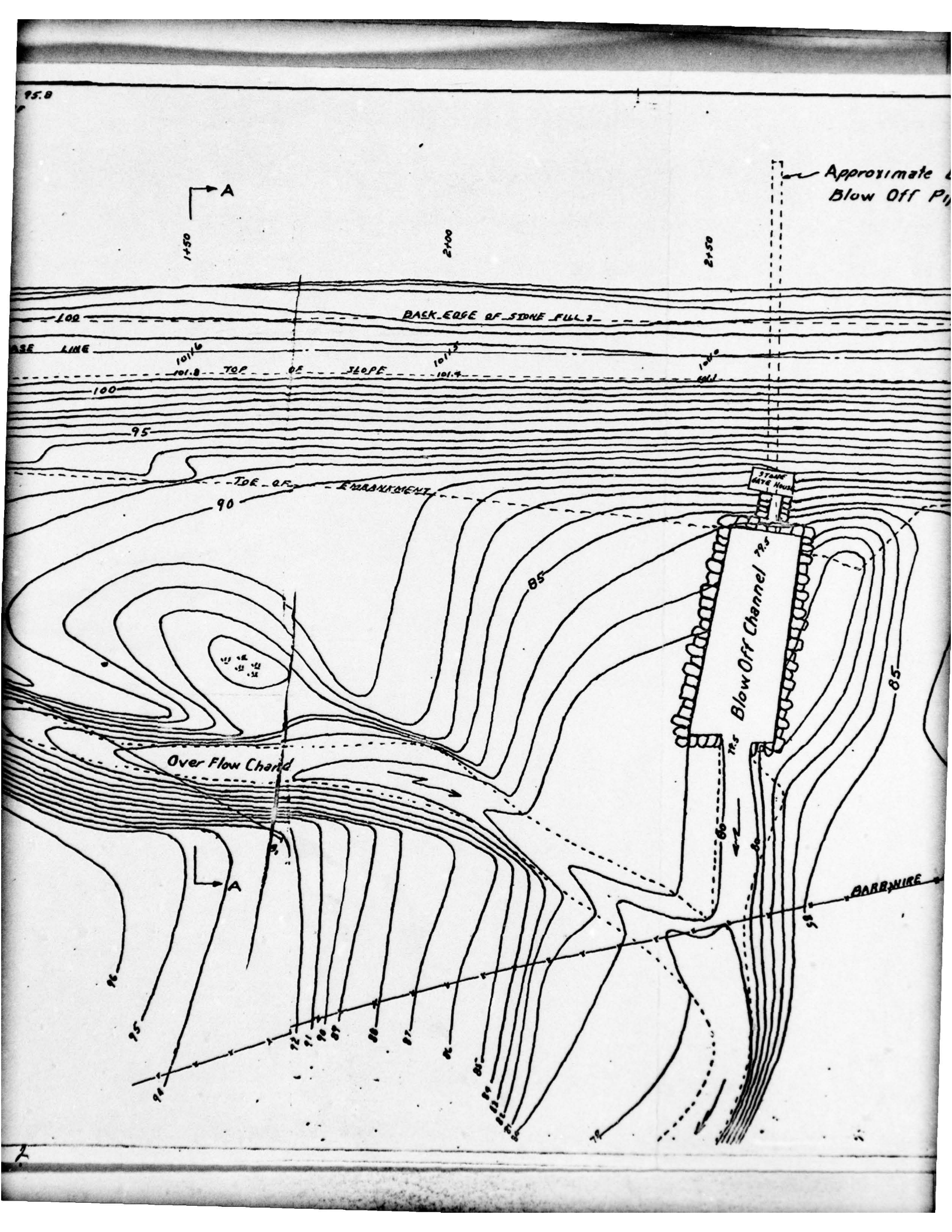
JANUARY 1979

PLATES

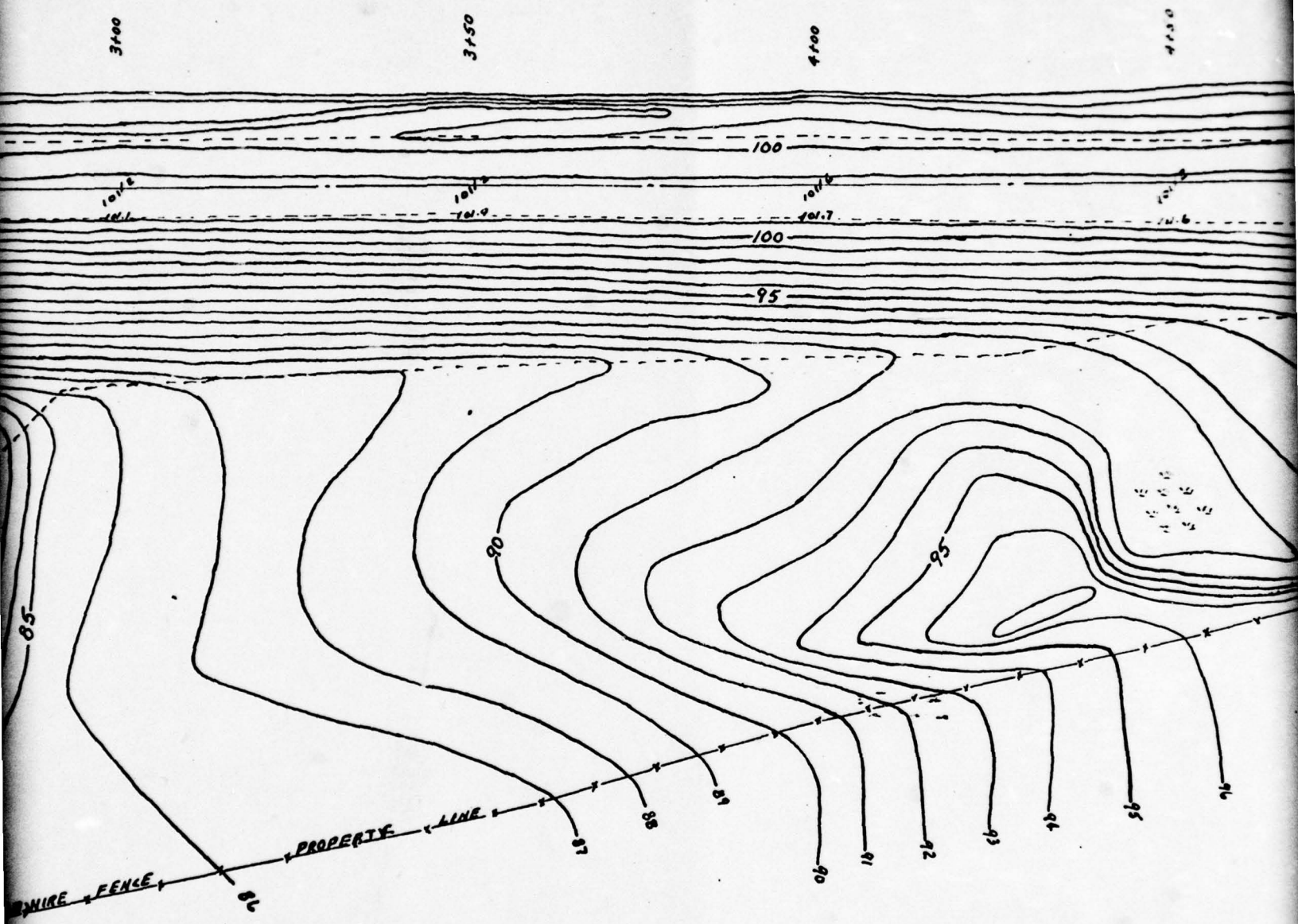

NESBITT DAM
RATTLESNAKE CREE
SCRANTON
SCRANTON CORPORATE BOUNDARY
Nesbit Reservoir
Rattlesnake Creek
Spring
Benjamin Pond
BM 1208
BM 1313
BM 1339
2000 0 2000
SCALE: 1 IN. = 2000 FT.

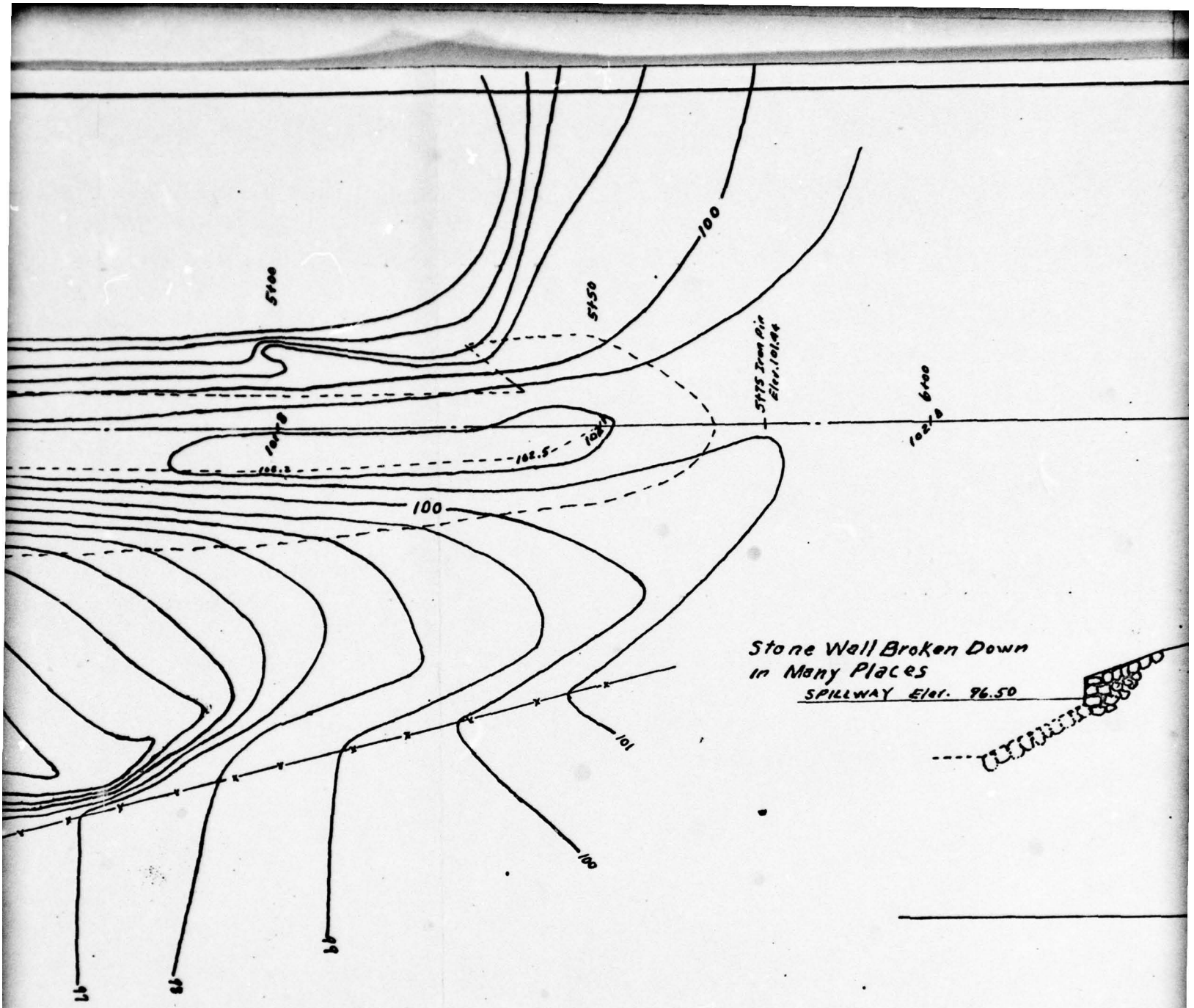

SCRANTON
Green
BDY
Run
Bear Swamp
Tooley Corners
Maple Lake
1613
Maple Lake
Cem
BM
1730
Quinlan
Corners
DIKE
MAPLE LAKE DAM
RATTLESNAKE CREEK
Rattlesnake
Creek
Springs
Benjamin
Pond
Spring Brook
Spring Brook Corners
S P R I N G B R
2000
000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MAPLE LAKE DAM
PENNSYLVANIA GAS AND WATER COMPANY
LOCATION MAP
JANUARY 1979
PLATE 1

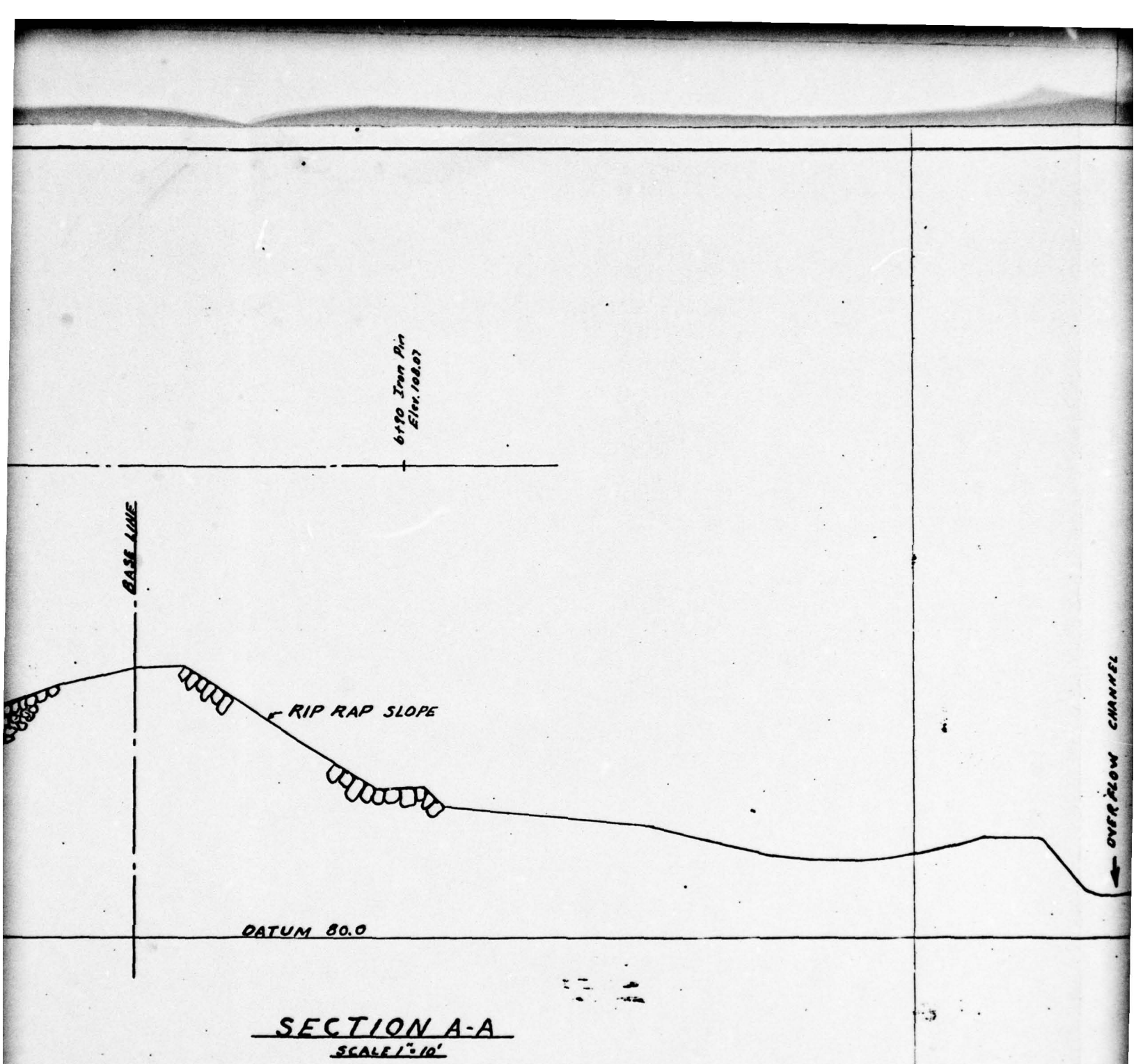

NOTE - WATER STARTS SPILLING AT ELEV. 95.8
DUE TO SECTION OF 2" SHEATHING BROKEN OFF
95.8
SPILLWAY ELEV. 96.5
2" T&G VERTICAL SHEATHING
10"x10" LOG
0+01 Iron Pin
Elev 100.97
0-40 Iron Pin
Elev 101.02
0+00
0+50
1+00
BASE
101.6
101.5
99.7
BM
ELEV. D100
BASE LINE
100
99
98
97
96
95
95.5
94.5
P.I.


95.8
A
1+50
2+00
2+50
Approximate
Blow Off Pi
100
BACK EDGE OF STONE FILL
BASE LINE
101.6
101.8
TOP OF SLOPE
101.4
100
95
TOE OF EMBANKMENT
90
STONE GATE HOUSE
85
Blow Off Channel
72.5
Over Flow Channel
A
BARB WIRE

imate Location Of 24"-16" C.I.
Off Pipe



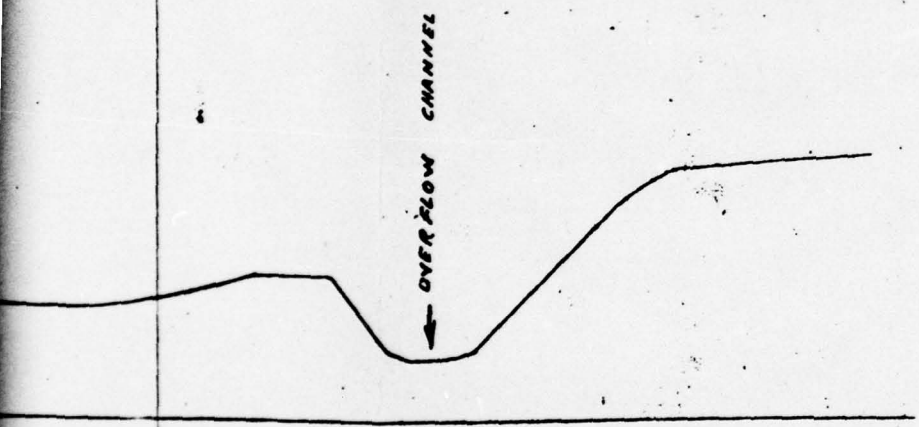

5100
5150
100
5175 Iron Pin
Elev. 101.84
6400
102.0
102.5
100
Stone Wall Broken Down
in Many Places
SPILLWAY Elev. 96.50
101
100



SECTION A-A
SCALE 1"=10'

NOTE- BM ELEV. 100 ESTABLISHED ON BASE OF 14" PINE TREE
13.5' Rt. OF STA 0+56.5
FOR FIELD NOTES - SEE LOOSE LEAF FILE No. 647
FOR LARGE SCALE PLAN - SEE DWG 0-717-L

SCRANT
M
PLAN O
SPRING
DRAWN
TRACED
CHECKED



RECORD DRAWING

SCRANTON-SPRING BROOK WATER SERVICE CO
WILKES BARRE, PA

MAPLE LAKE RESERVOIR

PLAN OF DAM AND SPILLWAY CHANNEL

SPRING BROOK TWP., LACKAWANNA CO., PA.

DRAWN BY J.H.	DATE 7-13-53	D-717-m
TRACED BY J.H.	SCALE 1"=20'	
CHECKED BY	APP'D BY	

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MAPLE LAKE DAM

PENNSYLVANIA GAS AND WATER COMPANY

EMBANKMENT
PLAN AND SECTION

JANUARY 1979 PLATE 2

6

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: MAPLE LAKE

NDI ID NO.: PA-00294 DER ID NO.: 35-42

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE PLATE 2 IS FROM 1953
REGIONAL VICINITY MAP	SEE PLATE 1
CONSTRUCTION HISTORY	BUILT 1893 NO MODIFICATIONS
TYPICAL SECTIONS OF DAM	NONE
OUTLETS: Plan Details Constraints Discharge Ratings	PLAN - PLATE 2 NO OTHER DETAILS

A-1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	1914 PENNSYLVANIA WATER SUPPLY COMMISSION REPORT
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	SOME DATA IN 1914 PENNSYLVANIA WATER SUPPLY COMMISSION REPORT
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	NONE
POSTCONSTRUCTION SURVEYS OF DAM	PLATE 2

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	NOT AVAILABLE
MONITORING SYSTEMS	NONE
MODIFICATIONS	DIKE CONSTRUCTED IN 1923.
HIGH POOL RECORDS	NONE
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	NONE
SPILLWAY: Plan Sections Details	PLATE 2
OPERATING EQUIPMENT: Plans Details	NONE
PREVIOUS INSPECTIONS Dates Deficiencies	1919 - LACK OF MAINTENANCE. 1925 - TOP OF dam UNEVEN SMALL FLOW AT ORIGINAL STREAM. SPILLWAY NOT WELL defined - SHOULD BE 600 ft NOTED DIKE BUILT IN 1928. 1927 - TOP OF DAM UNEVEN SEEPAGE. APPEARANCE POOR. 1929 - R.RAP UNEVEN. INSPECTOR believes THERE IS A CORE WALL. SETTLEMENT ON UPSTREAM SLOPE. SEEPAGE. BRUSH. POOR APPEARANCE.
(CONTINUED	1930 - UPSTREAM SLOPE SETTLED. ROCKS AND BRUSH IN SPILLWAY. POOR APPEARANCE. 1931 - TOP OF DAM UNEVEN. SPILLWAY - POOR. 1932 - AS 1931.

4-4

ENGINEERING DATA

ITEM	REMARKS
PREVIOUS INSPECTIONS (CONTINUED)	1933 - LEAKAGE AT OUTLET WORKS PIPE. BRUSH AND SWAMPY AT TOE. SPILLWAY - POOR. 1934 - SEEPAGE AT TOE ALONG RIGHT END. MAINTENANCE - POOR.
	1941 - POOR MAINTENANCE. TOP OF DAM UNEVEN. STONES IN DRY MASONRY WALL DISPLACED. BRUSH. TOE WET AND SWAMPY NEAR LEFT END. 1943 - AS 1941, EXCEPT MAINTENANCE IS FAIR.
	1953 - TOP OF DAM UNEVEN, HEAVY BRUSH ON DOWNSTREAM SLOPE. GENERAL APPEARANCE FAIR. 1957 - IN GENERAL, POOR.
	1965 - GENERAL APPEARANCE, POOR.

A-5

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: MAPLE LAKE County: LACKAWANNA State: PENNSYLVANIA

NDI ID No.: PA-00294 DER ID No.: 35-42

Type of Dam: EARTHFILL Hazard Category: HIGH

Date(s) Inspection: 9 NOVEMBER 1978 Weather: CLEAR Temperature: 40°F+

Soil Conditions: MOIST

Ground covered with newly fallen leaves

Pool Elevation at Time of Inspection: 1611.6 msl/Tailwater at Time of Inspection: 1597.2 msl

Inspection Personnel:

J. CROUSE (GFCC)

G. SMITH (GFCC)

D. KAUFFMAN (PGW)

A. WHITMAN (GFCC) Recorder

B-1

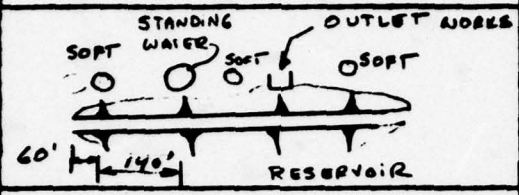
EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	SEE DETAIL ON SHEETS FOLLOWING INSPECTION FORM. There is evidence of recent movement on the upstream slope.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Downstream toe is bulged from 90' right of outlet works to outlet works. Minor bulging left of outlet works.	Major bulges are 1'± high.
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	Apparent sliding has occured on upstream slope over 50%+ of the length	
CREST ALIGNMENT: Vertical Horizontal	Vertical - see survey data following inspection forms. Horizontal along ℄ - no defects.	
RIPRAP FAILURES	What used to be a vertical dry masonry wall is bulged and offset severly. This is related to the apparent sliding.	Riprap below toe of wall - no defects

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	NONE	
ANY NOTICEABLE SEEPAGE		AREA AT DOWNSTREAM TOE HAS POOR DRAINAGE
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	
BRUSH	MATURE TREES AT TOE. YOUNGER TREES AND BRUSH ON ENTIRE DOWNSTREAM SLOPE. TOP HAS MUCH BRUSH.	

DIKE

SHEET 1 OF 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
UNUSUAL MOVEMENT, SLOUGHING, & JUNCTION WITH ABUTMENT	NONE	
CREST ALIGNMENT	HORIZONTAL ALONG ℄ - NO DEFECTS VERTICAL - SEE SURVEY DATA ON SHEETS FOLLOWING INSPECTION FORMS	
RIPRAP FAILURES	RIPRAP BARELY VISIBLE BECAUSE OF BRUSH.	
INSTRUMENTATION & DRAINS	NONE	
NOTICEABLE SEEPAGE	DOWNSTREAM TOE IS AT EDGE OF SWAMP. WATER IN SWAMP IS HIGHER THAN POOL ON DAY OF INSPECTION.	
BRUSH	FAIRLY LARGE TREES AND MUCH BRUSH COVERS EMBANKMENT.	

D-17

OUTLET WORKS

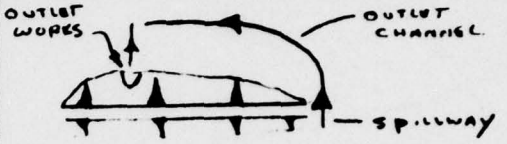
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		GATE PARTIALLY OPEN ON DAY OF INSPECTION. OUTLET NOT VISIBLE.
INTAKE STRUCTURE	SUBMERGED	
OUTLET STRUCTURE	SEE SKETCH ABOVE	
OUTLET CHANNEL	DRY MASONRY WALLS SURROUNDING STILLING POOL	
EMERGENCY GATE	NONE	

B-5

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
~~CONCRETE~~ WEIR	USED TO BE LOGS ACROSS SPILLWAY. LOGS ARE ROTTEN, TOP LOG IS DISPLACED.	AS EXISTS, IT IS A NATURAL CHANNEL WITH POORLY DEFINED CONTROL SECTION.
APPROACH CHANNEL	SHORT UNEVEN CHANNEL TO RESERVOIR. SEE SURVEY DATA ON SHEETS FOLLOWING INSPECTION FORM.	
DISCHARGE CHANNEL	SEVERE EROSION ON LEFT BANK. LESSER EROSION ON RIGHT BANK. DEBRIS IN CHANNEL.	
BRIDGE AND PIERS	NONE	

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	ABOUT 50%- VERY FLAT OTHER 50%- ROLLING HILLS	
SEDIMENTATION	NO REPORTED OR APPARENT PROBLEMS	
WATERSHED DESCRIPTION	MOSTLY WOODED SOME CONTROLLED BY PGW SOME SUBURBAN development & FARM FIELDS.	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: **Obstructions** **Debris** **Other**	MINOR DEBRIS	NOT A DEFICIENCY
SLOPES	STEEP	
APPROXIMATE NUMBER OF HOMES AND POPULATION	AT LEAST TWO DWELLINGS WOULD BE FLOODED BY FAILURE. TWO OTHERS WOULD MOST PROBABLY BE FLOODED.	NESBITT RESERVOIR is downstream.

B-9

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
_____ SHEET NO. ____ OF ____ SHEE
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SURVEY DATA ACQUIRED FOR THIS INSPECTION
CONVERSION OF DAM DATUM TO USGS DATUM

(FROM BM AT 100.0)

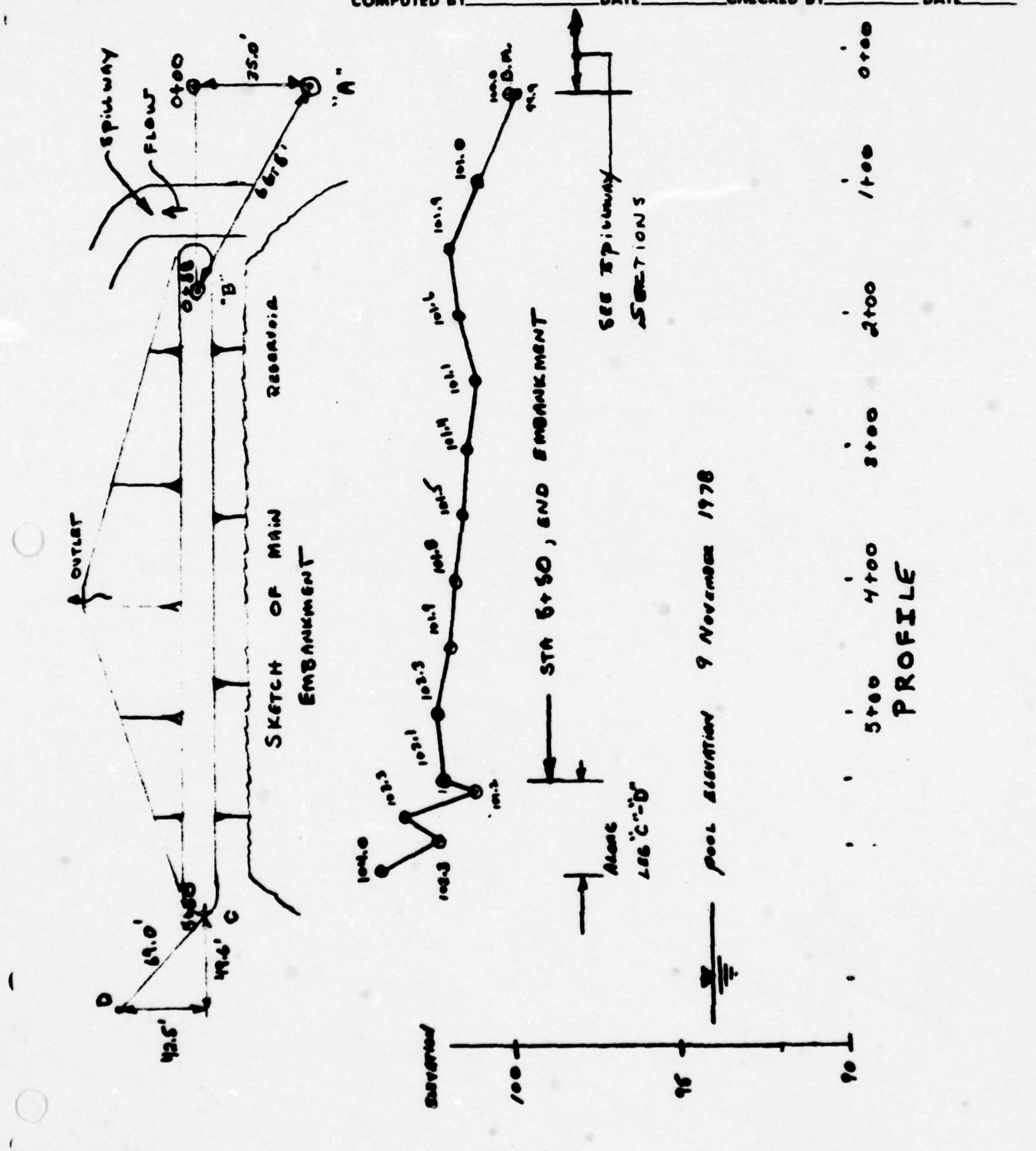
SPILLWAY ELEV = 95.5 APPROXIMATE OWNER DATUM
= 1613 APPROXIMATE USGS DATUM
Δ = 1517.5

∴ ADD 1517.5 TO OWNER DATUM OR SUBTRACT 1517.5 FROM USGS DATUM

USGS DATUM OBTAINED FROM POOL ELEVATION ON USGS TOPO SHEET

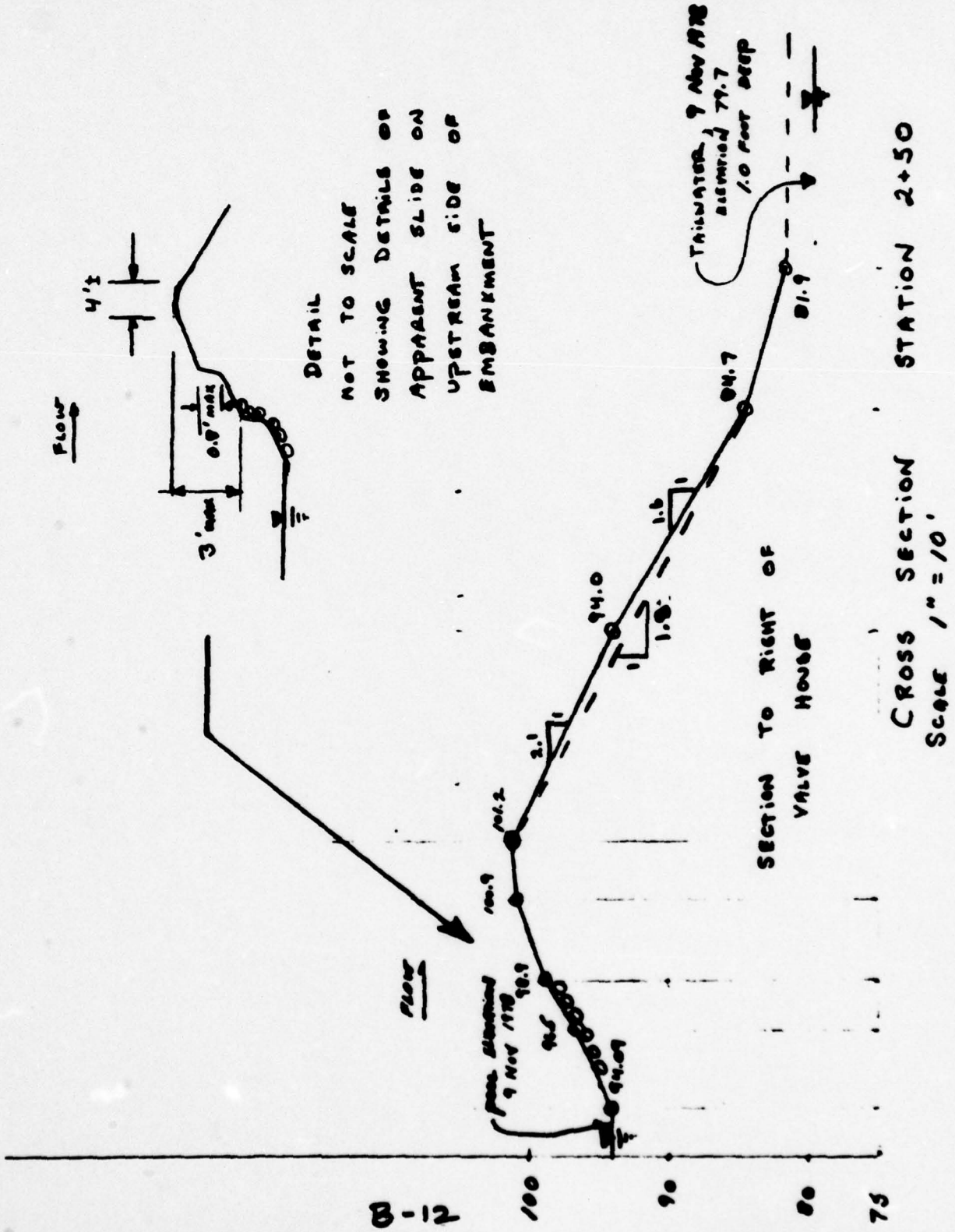
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT: Maple Lake Dam — Survey Data   FILE NO. ____
SHEET NO. ____ OF ____ SHE
FOR ____
COMPUTED BY ____ DATE ____ CHECKED BY ____ DATE ____



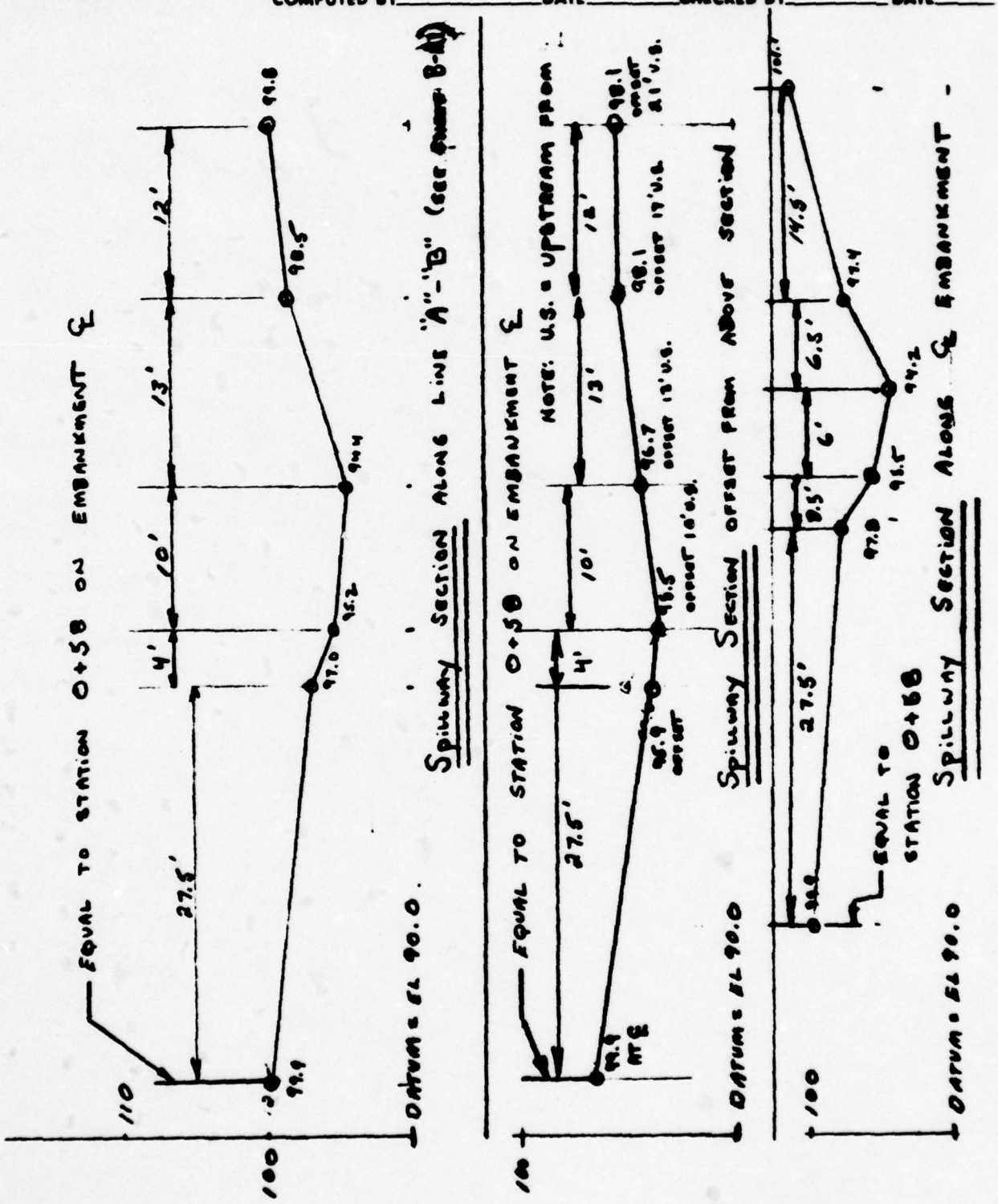
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Maple Lake Dam FILE NO.
Survey Data SHEET NO. OF SHE
FOR
COMPUTED BY DATE CHECKED BY DATE



GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

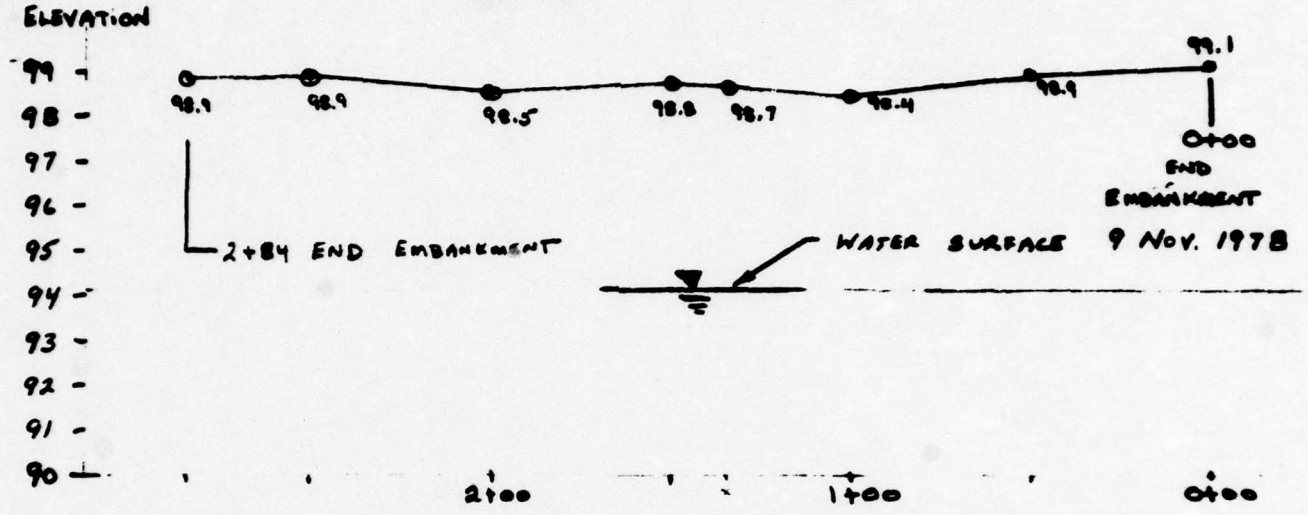
SUBJECT MAPLE LAKE — FILE NO.
SURVEY DATA — SHEET NO. ___ OF ___ SHE
FOR
COMPUTED BY ___ DATE ___ CHECKED BY ___ DATE ___



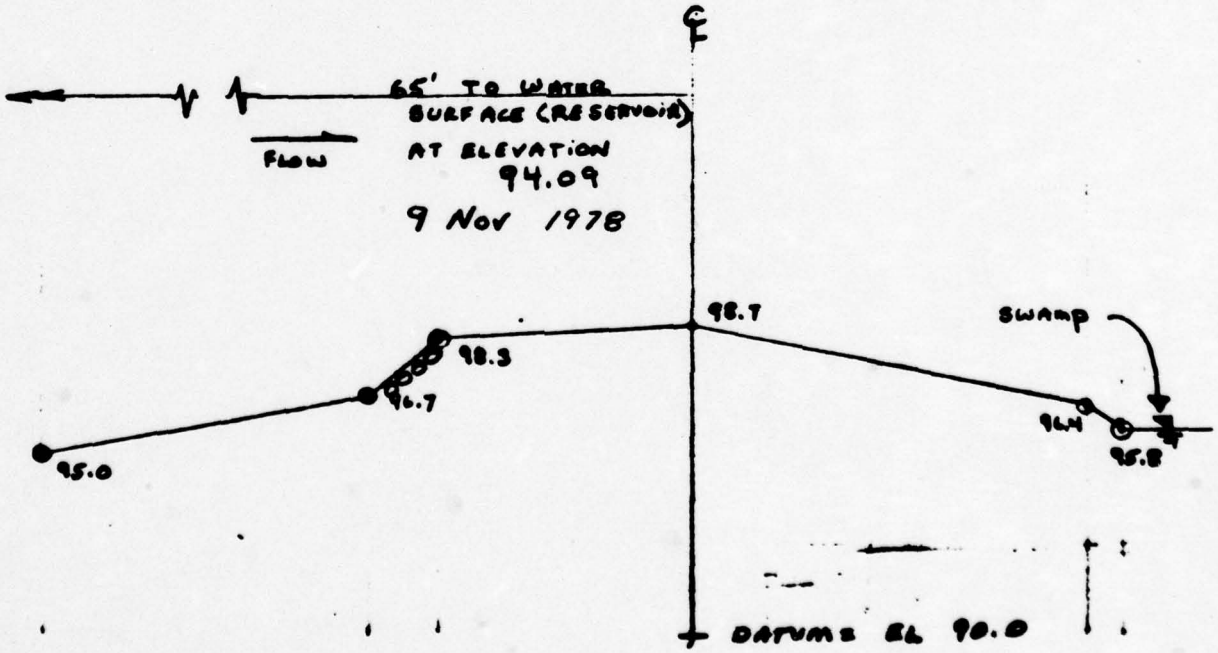
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Maple Lake Dam FILE NO. _____
Survey Data SHEET NO. _____ OF _____ SHE
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

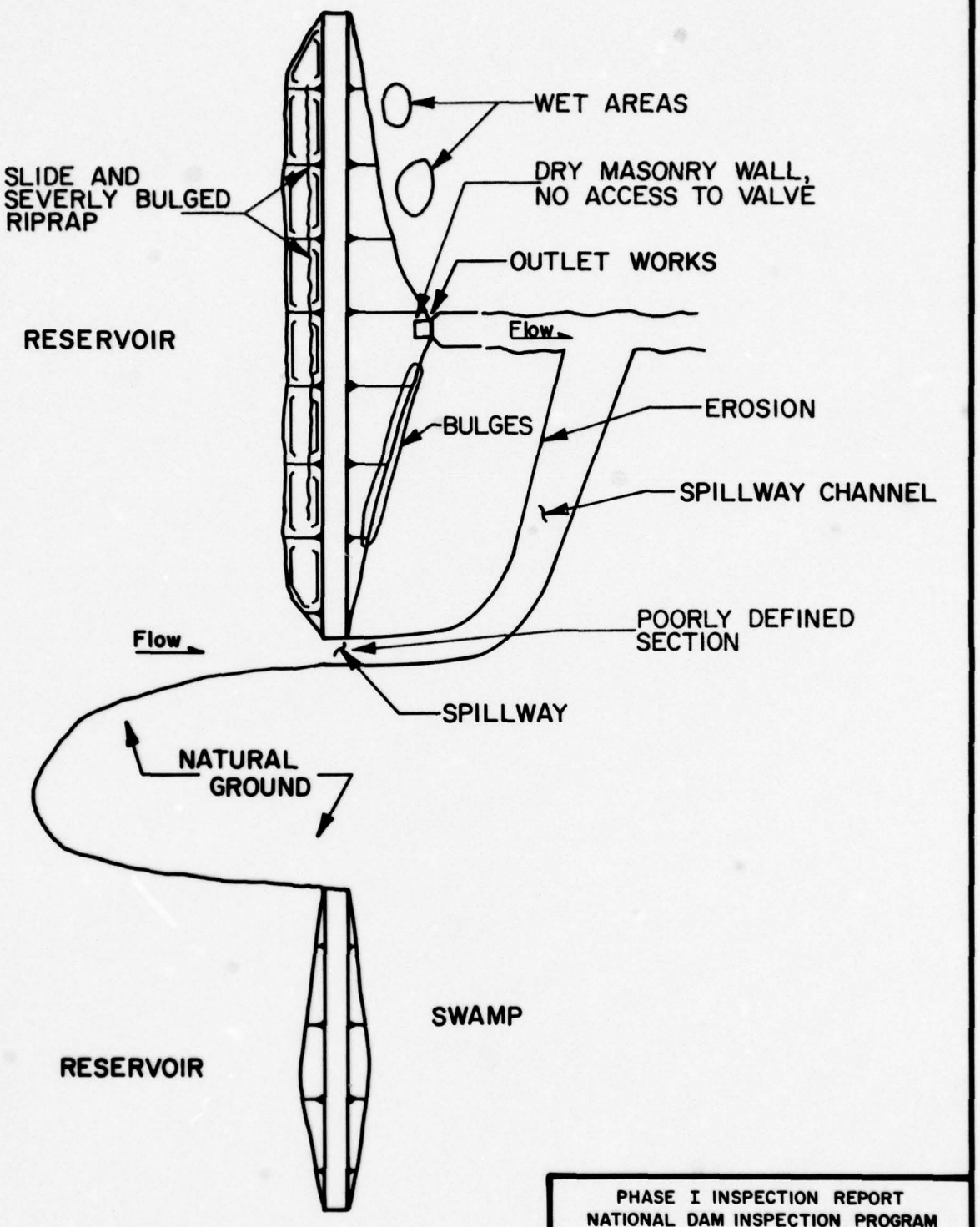
DIKE



PROFILE - LOOKING DOWNSTREAM



SECTION AT STATION 1+35 (DIKE)
SCALE 1" = 5'



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MAPLE LAKE DAM

PENNSYLVANIA GAS AND WATER COMPANY

RESULTS OF VISUAL INSPECTION

JANUARY 1979 PLATE B-1

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

APPENDIX C

HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

APPENDIX C

SUSQUEHANNA River Basin

Name of Stream: RATTLESNAKE CREEK

Name of Dam: MAPLE LAKE

NDI ID No.: PA-00294

DER ID No.: 35-42

Latitude: N 41° 19' 35" Longitude: W 75° 35' 00"

Top of Dam (low spot) Elevation: 1617.4

Streambed Elevation: 1596.2 Height of Dam: 23* ft

Reservoir Storage at Top of Dam Elevation: 1151** acre-ft

Size Category: INTERMEDIATE

Hazard Category: HIGH (see Section 5)

Spillway Design Flood: PMF

* BASED ON TOP ELEVATION OF 1619.4

** EXISTING TOP OF DAM

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS

NESBITT	5.5 (stream miles)	101	5,034	LARGE-HIGH HAZARD, SERIOUSLY INADEQUATE SPILLWAY

SUSQUEHANNA River Basin

Name of Stream: RATTLESNAKE CREEK

Name of Dam: MAPLE LAKE

NDI ID No.: PA-00294

DER ID No.: 35-42

Latitude: N 41° 20' Longitude: W 75° 35'

DETERMINATION OF PMF RAINFALL

For Area A

which consists of Subareas A1 of 0.96 sq. mile

Total Drainage Area 0.96 sq. mile

PMF Rainfall Index = 22.15 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone	N/A	N/A
Geographic Adjustment Factor	97%	1.0
Revised Index Rainfall	21.5	N/A

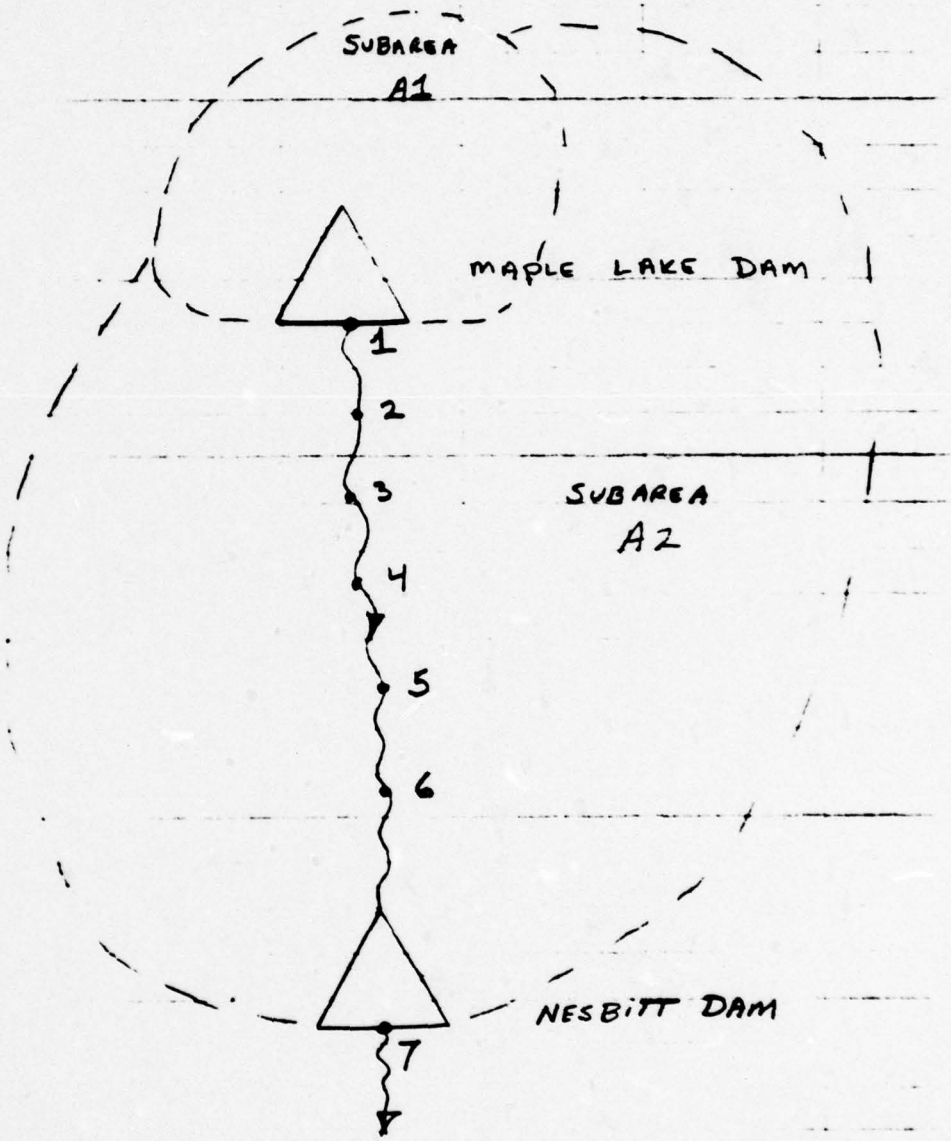
RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	118
12 hours	127
24 hours	136
48 hours	142
72 hours	145
96 hours	N/A

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SKETCH OF SYSTEM



Data for Dam at Outlet of Subarea A1
(see Sketch on Sheet C-4)

Name of Dam: MAPLE LAKE Sheet 1 of __

Height: 23 (existing)

Spillway Data:	Existing Conditions	Design Conditions
Top of Dam Elevation	1617.4	1619.4
Spillway Crest Elevation	1613.0	1613.0
Spillway Head Available (ft)	4.4	6.4
Type Spillway	EXCAVATED CHANNEL WITH CONTROL SECTION	
"C" Value - Spillway	2.7	2.7
Crest Length - Spillway (ft)	VARIES	VARIES
Spillway Peak Discharge (cfs)	504 x 500	1310
Auxiliary Spillway Crest Elevation	NONE	NONE
Auxiliary Spillway Head Available (ft)	N/A	N/A
Type Auxiliary Spillway	N/A	N/A
"C" Value - Auxiliary Spillway	N/A	N/A
Crest Length - Auxiliary Spillway (ft)	N/A	N/A
Auxiliary Spillway Peak Discharge (cfs)	N/A	N/A
Combined Spillway Discharge (cfs)	500	1310

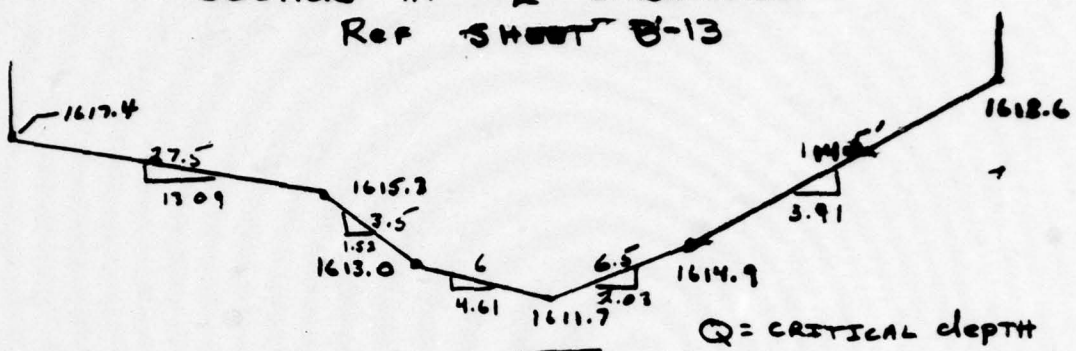
Spillway Rating Curve:

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
1613.0	0	NONE	0
1614.0	23		23
1615.0	100		100
1616.0	240		240
1617.0	380		380
1618.0	690		690
1619.0	1150		1150
1620.0	1550		1550

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Main Spillway FILE NO.
SHEET NO. OF SHEE
FOR
COMPUTED BY DATE CHECKED BY DATE

Section at ℄ Embankment
Ref Sheet B-13



Q = critical depth

W.S Elev	Top width FT	Area FT^2	$Q = \sqrt{\frac{A^3 g}{T}}$ CFS	$hv = \frac{Q^2}{2gA^2}$ FT	EGL = Pool Elev
1611.7	0	0	0	0	0
1613.0	8.64	5.61	25.68	.33	1613.3
1614.9	15.39	28.44	219	.92	1615.8
1615.3	17.56	35.03	281	1.00	1616.3
1617.4	53.28	109.41	890	1.03	1618.4
1618.6	58	176.2	1,743	1.52	1620.1
1619.0	58	199.4	2097	1.72	1620.7
1620.0	58	257.4	3,076	2.22	1622.2
1625.0	58	547.4	9,540	4.72	1629.7

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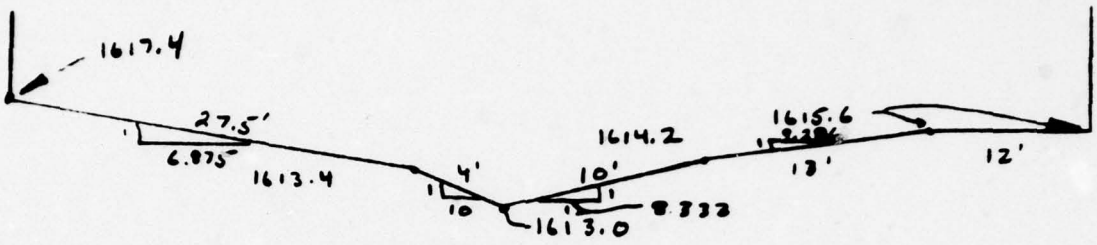
SHEET NO. OF SH
FOR
COMPUTED BY DATE CHECKED BY DATE

REFERENCE ~~SHEET~~ B-13

Spillway Section offset from line A-B

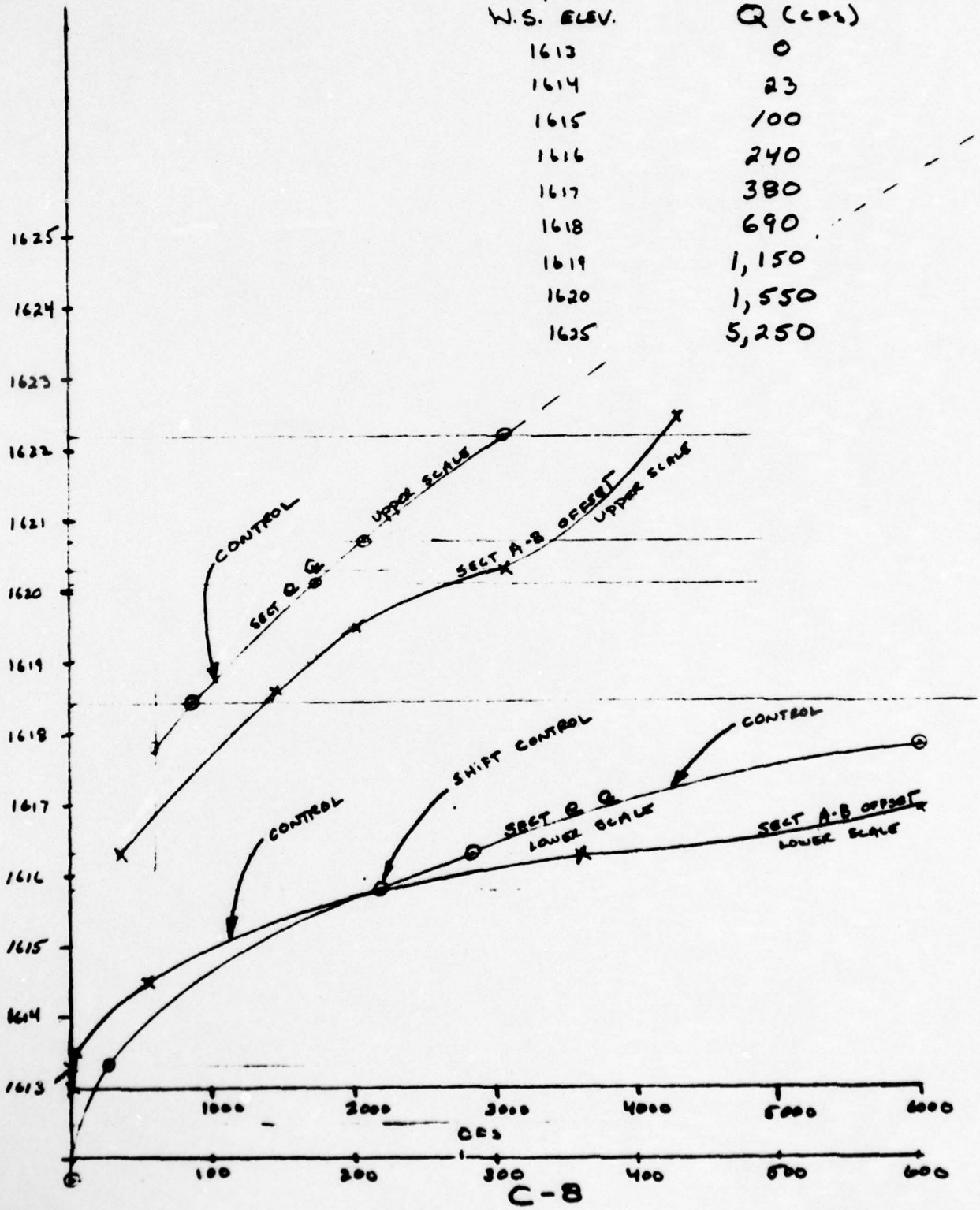


W.S. ELEV	Topwidth FT	AREA FT²	$Q=\sqrt{\frac{A^3g}{T}}$ CFS	$hv=\frac{Q^2}{2gA^2}$ FT	EGL = Pool Elev
1613.0	0	0	0	0	1613.0
1613.4	7.333	1.467	3.7	.10	1613.5
1614.2	19.5	12.2	54.7	.31	1614.5
1615.6	42.1	55.3	360	.66	1616.3
1617.4	66.5	163.8	1,459	1.23	1618.6
1618.0	66.5	203.7	2,022	1.53	1619.5
1619.0	66.5	270.2	3,090	1.31	1620.3
1620.0	66.5	336.7	4,298	2.53	1622.5
1625.0	66.5	669.2	12,042	5.03	1630.0

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Spillway Rating Curve FILE NO. _____
SHEET NO. _____ OF _____ SHI
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Composite W.S. Elev.	Rating Curve Q (cfs)
1613	0
1614	23
1615	100
1616	240
1617	380
1618	690
1619	1,150
1620	1,550
1625	5,250



Data for Dam at Outlet of Subarea A1

Name of Dam: MAPLE LAKE Sheet 2 of ___

Outlet Works Rating:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet (APPROXIMATE)	1596.2	NONE	NONE
Invert of Inlet	NOT AVAILABLE	___	___
Type	24" CIP	___	___
Diameter (ft) = D	2.0	___	___
Length (ft) = L	70±	___	___
Area (sq. ft) = A	3.14	___	___
N	.014	___	___
K Entrance	0.5	___	___
K Exit	1.0	___	___
K Friction* $= 29.1_N{}^2L/R^{4/3}$	1.01	___	___
Sum of K	2.51	___	___
$(1/K)^{0.5} = C$	.631	___	___
Maximum Head (ft) = HM	21.2	___	___
$Q = C A \sqrt{2g(HM)}$ (cfs)	73	___	___
Q Combined (cfs)	≈ 70	___	___

* R = Hydraulic Radius = (Area/Wetted Perimeter) = D/4 for Circular Conduits.

Data for Dam at Outlet of Subarea A1

Name of Dam: MAPLE LAKE Sheet 3 of ___

Storage Data:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1593.0 = ELEVO*	0	0	0	
1596.2 ~~= ELEV1~~	2.8 ~~= A1~~		3 ~~= S1~~	
1613.0 = ELEV1	99 = A1	214	657 = S1	
1617.4	126.3	375	1151	
1619.4	139.8	462	1417	
1620.0	144	490	1502	
**				

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at ~~Top of Dam~~ Normal Pool is 1.6 percent of watershed.

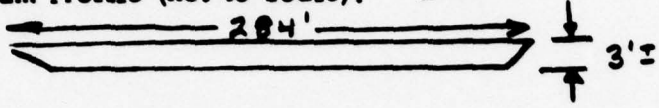
Remarks: ___

Data for Dam at Outlet of Subarea A1

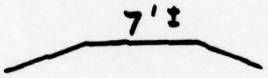
Name of Dam: MAPLE LAKE Sheet 4 of __

Breach Data:

Sketch of Dam Profile (not to scale): Dike



Sketch of Top of Dam (not to scale):



Soil Type from Visual Inspection: SANDY SILT

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) $A = L \cdot d$

HMAX = $(4/9\ V^2/C^2)$ = 0.2 ft., C = 2.7

HMAX + Top of Dam Elev. (1616.40) = 1616.6 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 70 ft (width of bottom of breach)

Z = 1 (side slopes of breach)

ELBM = 1613.0 (bottom of breach elevation, minimum of zero storage elevation)

WSEL = 1613.0 (normal pool elevation)

T FAIL = 6 mins

= 0.1 hrs (time for breach to develop) USING 0.1 HOURS FOR EVERY 25 FT OF HEIGHT.

SUSQUEHANNA River Basin

Name of Stream: RATTLESNAKE CREEK

Name of Dam: MAPLE LAKE

NDI ID No.: PA-00294

DER ID No.: 35-42

Latitude: N 41° 19' 35" Longitude: W 75° 35' 00"

Drainage Area: 0.96 sq. mile

Data for Subarea: A-1 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: MAPLE LAKE

Drainage Area of Subarea: 0.96 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 1.1 miles

L_{CA} = Length of Main Watercourse to the centroid = 0.5 mile

From NAB Data: AREA 11, PLATE E

Cp = 0.62 L' = DISTANCE FROM RESERVOIR TO DIVIDE = 0.44 mi.

C_T = 1.5 $T_p = C_T \times (L')^{0.6} = 0.91$

$Tp = C_T \times (L \times L_{CA})^{0.3}$ = 1.25 (hrs) ← NOT USED

Flow at Start of Storm = 1.5 cfs/sq. mile x Subarea D.A = 1.5 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: _____

Data for Dam at Outlet of Subarea A2
(see Sketch on Sheet C-4)

Name of Dam: NESBITT Sheet 1 of

Height: 101 FT. (existing)

Spillway Data: FROM PHASE 1 REPORT

	Existing Conditions	Design Conditions
Top of Dam Elevation	1166.0	SAME
Spillway Crest Elevation	1156.0	
Spillway Head Available (ft)	10.0	
Type Spillway	BROAD CRESTED WEIR	
"C" Value - Spillway	3.09	
Crest Length - Spillway (ft)	200.0	
Spillway Peak Discharge (cfs)	19,540	
Auxiliary Spillway Crest Elevation	NONE	
Auxiliary Spillway Head Available (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spillway		
Crest Length - Auxiliary Spillway (ft)		
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)	19,540	

Spillway Rating Curve:

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
NOT	REQUIRED		

Data for Dam at Outlet of Subarea A2

Name of Dam: NESBITT Sheet 2 of __

Outlet Works Rating:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet			
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L	FROM PHASE 1 REPORT		
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction* = $29.1_N{}^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5}$ = C			
Maximum Head (ft) = HM			
Q = C A $\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)	550 (TOTAL)		

* R = Hydraulic Radius = (Area/Wetted Perimeter) = D/4 for Circular Conduits.

Data for Dam at Outlet of Subarea A2

Name of Dam: NESBITT Sheet 3 of __

Storage Data:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1056.7 = ELEVO*	0	0	0	
1156.0 = ELEV1	116 = A1	1250	3837 = S1	
1166.0	123	1640	5034	
↔				

* ELEVO = ELEV1 - $(3S_1/A_1)$.

~~↔ Planimetered contour at least 10 feet above top of dam~~

Reservoir Area at Top of Dam is N/A percent of watershed.

Remarks: _____

APPENDIX C

SUMMARY

	A1 Subarea	A2 Subarea	Subarea	Subarea	Total
Drainage Area (sq. mile)	0.96	N/A			
PMF:					
Peak Outflow (cfs)	2411	1822			
Total Runoff (inches)	-	-			
Dam at Outlet?	YES	YES			
Is Dam Overtopped?	YES	NO			
Depth of Overtopping (ft)	1.69	-			
One-Half PMF:	MAPLE LAKE	NESBITT			
Peak Outflow (cfs)	578	387			
Total Runoff (inches)	-	-			
Dam at Outlet?	YES	YES			
Is Dam Overtopped?	YES	NO (EVEN IF UPSTREAM DAM FAILS)			
Depth of Overtopping (ft)	-	-			
Does Dam Fail?	YES	NO			
Peak Failure Outflow (cfs)	1870	-			
At time (hrs)	-	-			
Spillway (percent of PMF)	42	N/A			

DOWNSTREAM SUMMARY

	½ PMF Peak Water Surface Elevation Before Failure	After Failure	Remarks
Cross Section 3	1501.2	1504.0	Δ = 2.8' SIGNIFICANT
Cross Section 5	1320.2	1320.7	
Cross Section			
Cross Section			
Cross Section			

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEET
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SELECTED COMPUTER OUTPUT

* NOTE: ONLY PLAN 1 USED

6513

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  17 OCT 79
**********
    1              A1                                   MAPLE LAKE DAM
    2              A2                                      RATTLESNAKE CREEK NEAR NESBITT DAM
    3              A3                                       CFCC
    4              B     300        0       15        0        0        0        0        0       -4        0
    5              B1      5
    6              J       1        6        1
    7              J1      1       .8       .7       .6       .5       .4
    8              K       0        1                                          1
    9              K1                                   RUNOFF INTO MAPLE LAKE RESERVOIR
   10              M       1        1     0.96                .96                                  1
   11              P               21.5      118      127      136      142      145
   12              T                                                          1.00     .050              .160
   13              W    0.91      .62
   14              X     1.5     -.05      2.0
   15              K       1        1                                          1
   16              K1                                   ROUTE RUNOFF THROUGH MAPLE LAKE
   17              Y                                        1        1
   18              Y1    144                                                        -1613       -1
   19              Y4   1613     1614     1615     1616     1617     1618     1619     1620     1625
   20              Y5      0       23      100      240      380      690     1150     1550     5250
   21              SA     .1      2.9       99      144
   22              SE   1593   1596.2     1613     1620
   23              SS   1613
   24              SD1616.4      2.7      1.5      2.4
   25              K       1        2                                          1
   26              K1                                      CROSS SECTION AT 2
   27              Y                                        1        1
   28              Y1      1                                                          -1
   29              Y6    .09      .03      .09     1580     1640     2000      .02
   30              Y7      0     1640     1350     1620     1700     1585     1705     1580     1715     1580
   31              Y7   1720     1585     2150     1600     3450     1640
   32              K       1        3                                          1
   33              K1                                      CROSS SECTION AT 3
   34              Y                                        1        1
   35              Y1      1                                                          -1
   36              Y6    .07      .05      .07     1500     1580     1500    .0533
   37              Y7      0     1590      500     1520      550     1500      565     1500      568     1500
   38              Y7    570     1500      900     1560     1300     1590
   39              K       1        4
   40              Y                                        1        1
   41              Y1      1                                                          -1
   42              Y6    .06      .04      .06     1400     1460     6600     .015
   43              Y7      0     1460      250     1420      390     1405      400     1400      410     1400
   44              Y7    420     1405      610     1420      900     1460
   45              K       1        5
   46              Y                                        1        1
   47              Y1      1                                                          -1
   48              Y6    .06      .04      .06     1320     1400    10000     .018
   49              Y7      0     1400      200     1380      400     1360      490     1320      650     1320
   50              Y7    750     1360     1000     1380     1250     1400
```

C-18

```
51          K     1      6
52          Y                      1      1
53          Y1    1                                        -1
54          Y6    .06    .05     .06    1157   1240   1200   .037
55          Y7    0      1240    100    1200   325    1160   330    1157    395    1157
56          Y7    400    1160    550    1200   820    1240
57          K     1      7                                  1
58          K1                                ROUTE THROUGH NESBITT RESERVOIR
59          Y                      1      1
60          Y1    1                                        -1156
61          BA    .5     116     123
62          BE    1057   1156    1166
63          BB    1156   200     3.09   1.5
64          BD    1166   2.7     1.5    355.5
65          K     99
```

C-19

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 1.00	RATIO 2 .80	RATIO 3 .70	RATIO 4 .60	RATIO 5 .50	RATIO 6 .40
HYDROGRAPH AT	1	.96	1	3656.	2925.	2559.	2194.	1828.	1462.
	(	2.49)	(	103.52)(	82.82)(	72.47)(	62.11)(	51.76)(	41.41)(
ROUTED TO	1	.96	1	2411.	1666.	1308.	948.	578.	286.
	(	2.49)	(	68.26)(	47.19)(	37.03)(	26.85)(	16.38)(	8.06)(
ROUTED TO	2	.96	1	2403.	1668.	1308.	948.	580.	286.
	(	2.49)	(	68.05)(	47.23)(	37.04)(	26.64)(	16.42)(	8.06)(
ROUTED TO	3	.96	1	2406.	1670.	1310.	945.	579.	286.
	(	2.49)	(	68.08)(	47.29)(	37.09)(	26.76)(	16.40)(	8.06)(
ROUTED TO	4	.96	1	2391.	1657.	1300.	942.	574.	283.
	(	2.49)	(	67.69)(	46.93)(	36.81)(	26.67)(	16.25)(	8.02)(
ROUTED TO	5	.96	1	2353.	1638.	1284.	928.	566.	282.
	(	2.49)	(	66.64)(	46.37)(	36.36)(	26.29)(	16.02)(	7.99)(
ROUTED TO	6	.96	1	2351.	1639.	1285.	929.	566.	282.
	(	2.49)	(	66.57)(	46.41)(	36.39)(	26.30)(	16.03)(	7.99)(
ROUTED TO	7	.96	1	1827.	1222.	927.	641.	387.	232.
	(	2.49)	(	51.60)(	34.59)(	26.25)(	18.15)(	10.97)(	6.57)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1613.00	1613.00	1616.40
STORAGE	667.	667.	1058.
OUTFLOW	0.	0.	294.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1619.09	1.69	1250.	2411.	7.50	41.50	0.00
.80	1617.66	1.26	1104.	1666.	6.50	42.00	0.00
.70	1617.43	1.03	1165.	1308.	6.00	42.25	0.00
.60	1617.17	.77	1132.	948.	5.50	42.50	0.00
.50	1616.86	.46	1091.	578.	4.25	43.00	0.00
.40	1616.31	0.00	1028.	284.	0.00	43.25	0.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2403.	1586.7	41.50
.80	1668.	1585.8	42.00
.70	1308.	1585.0	42.25
.60	948.	1584.2	42.50
.50	580.	1583.4	43.00
.40	284.	1581.8	43.50

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2404.	1504.6	41.75
.80	1670.	1503.6	42.00
.70	1310.	1502.7	42.25
.60	945.	1501.9	42.50
.50	579.	1501.2	43.00
.40	284.	1500.6	43.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2391.	1406.9	41.75
.80	1657.	1406.1	42.25
.70	1300.	1405.3	42.50
.60	942.	1404.5	42.75
.50	574.	1403.6	43.00
.40	283.	1402.3	43.75

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2353.	1321.0	42.00
.80	1638.	1320.7	42.50
.70	1284.	1320.6	42.75
.60	928.	1320.4	43.00
.50	566.	1320.2	43.25
.40	282.	1320.1	44.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2351.	1159.2	42.00
.80	1639.	1158.6	42.50
.70	1285.	1158.2	42.75
.60	929.	1157.9	43.00
.50	566.	1157.5	43.50
.40	282.	1157.3	44.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1156.00	1156.00	1166.00
STORAGE	4096.	4096.	5291.
OUTFLOW	0.	0.	19543.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1159.06	0.00	4336.	1822.	0.00	43.25	0.00
.80	1157.58	0.00	4279.	1222.	0.00	43.75	0.00
.70	1157.31	0.00	4268.	927.	0.00	44.00	0.00
.60	1157.02	0.00	4215.	641.	0.00	44.50	0.00
.50	1156.73	0.00	4181.	387.	0.00	45.00	0.00
.40	1156.52	0.00	4156.	232.	0.00	47.25	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  17 OCT 79
**********
    1              A1
    2              A2                    MAPLE LAKE DAM
    3              A3                       RATTLESNAKE CREEK NEAR NESBITT DAM
    4              B     300        0       15         0         0         0         0         0        -4         0
    5              B1      5
    6              J       2        1        1
    7              J1    .5
    8              K       0        1                                                  1
    9              K1                                  RUNOFF INTO MAPLE LAKE RESERVOIR
   10              M       1        1    0.96              .96                                                  1
   11              P               21.5      118       127       136       142       145
   12              T                                                              1.00      .050                .160
   13              W    0.91      .67
   14              X     1.5     -.05      2.0
   15              K       1        1                                                  1
   16              K1                                  ROUTE RUNOFF THROUGH MAPLE LAKE
   17              Y                                      1         1
   18              Y1    144                                                      -1613        -1
   19              Y4   1613     1614     1615      1616      1617      1618      1619      1620      1625
   20              Y5      0       23      100       240       380       690      1150      1550      5250
   21              SA     .1      2.8       99       144
   22              SE   1593   1596.2     1613      1620
   23              SS   1613
   24              SD1616.4      2.7      1.5       284
   25              SB     70        1     1613        .1      1613    1616.6
   26              SB     50        1     1613        .1      1613    1616.6
   27              K       1        2                                                  1
   28              K1                                  CROSS SECTION AT 2
   29              Y                                      1         1
   30              Y1      1                                                        -1
   31              Y6    .09      .03      .09      1580      1640      2000      .02
   32              Y7      0     1640     1350      1620      1700      1585      1705      1580      1715      1580
   33              Y7   1720     1585     2150      1600      3450      1640
   34              K       1        3                                                  1
   35              K1                                  CROSS SECTION AT 3
   36              Y                                      1         1
   37              Y1      1                                                        -1
   38              Y6    .07      .05      .07      1500      1580      1500      .0533
   39              Y7      0     1540      500      1520       550      1500       565      1500       568      1500
   40              Y7    570     1500      900      1560      1300      1580
   41              K       1        4
   42              Y                                      1         1
   43              Y1      1                                                        -1
   44              Y6    .06      .04      .06      1400      1460      6600      .015
   45              Y7      0     1460      250      1420       390      1405       400      1400       410      1400
   46              Y7    420     1405      610      1420       900      1460
   47              K       1        5
   48              Y                                      1         1
   49              Y1      1                                                        -1
   50              Y6    .06      .04      .06      1320      1400     10000      .015
```

C-24

```
51          Y7       0      1400      200      1380      400      1340      480      1320      650      1320
52          Y7     750      1340     1000      1380     1250      1400
53          K        1         6
54          Y                                    1         1
55          Y1       1
56          Y6     .06       .05       .06      1157      1240      1200      -1
57          Y7       0      1240      100      1200      325       1160      .037
58          Y7     400      1160      550      1200      820       1240      330      1157      395      1157
59          K        1         7
60          K1                                                                1
61          Y                                    1         1
62          Y1       1
63          $A      .5       116       123                                   -1156
64          $E    1057      1154      1166
65          $S    1156       200      3.09       1.5
66          $D    1166       2.7       1.5     355.5
67          K       99
```

ROUTE THROUGH NESBITT RESERVOIR

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50
HYDROGRAPH AT	1	.96	1	1828.
	(	2.49)	(	51.76)(
			2	1828.
			(	51.76)(
ROUTED TO	1	.96	1	1874.
	(	2.49)	(	53.06)(
			2	1518.
			(	42.98)(
ROUTED TO	2	.96	1	1913.
	(	2.49)	(	54.16)(
			2	1562.
			(	44.22)(
ROUTED TO	3	.96	1	1972.
	(	2.49)	(	55.84)(
			2	1603.
			(	45.39)(
ROUTED TO	4	.96	1	1741.
	(	2.49)	(	49.30)(
			2	1434.
			(	40.60)(
ROUTED TO	5	.96	1	1590.
	(	2.49)	(	45.01)(
			2	1320.
			(	37.37)(
ROUTED TO	6	.96	1	1594.
	(	2.49)	(	45.14)(
			2	1322.
			(	37.44)(
ROUTED TO	7	.96	1	968.
	(	2.49)	(	27.41)(
			2	843.
			(	23.87)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1613.00	1613.00	1616.40
STORAGE	667.	667.	1038.
OUTFLOW	0.	0.	296.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1616.68	.28	1072.	2010.	1.00	42.10	42.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1613.00	1613.00	1616.40
STORAGE	667.	667.	1038.
OUTFLOW	0.	0.	296.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1616.68	.28	1073.	1594.	1.25	42.10	42.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1913.	1586.3	42.50

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1562.	1585.5	42.50

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1972.	1504.0	42.50

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1603.	1503.3	42.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1741.	1406.3	42.75

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1434.	1405.6	42.75

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1590.	1320.7	43.00

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1320.	1320.6	43.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1594.	1158.5	43.00

PLAN 2 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1322.	1158.3	43.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1156.00	1156.00	1166.00
STORAGE	4096.	4096.	5291.
OUTFLOW	0.	0.	19543.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1157.35	0.00	4253.	968.	0.00	44.50	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1156.00	1156.00	1166.00
STORAGE	4096.	4096.	5291.
OUTFLOW	0.	0.	19543.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1157.23	0.00	4239.	843.	0.00	44.75	0.00

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

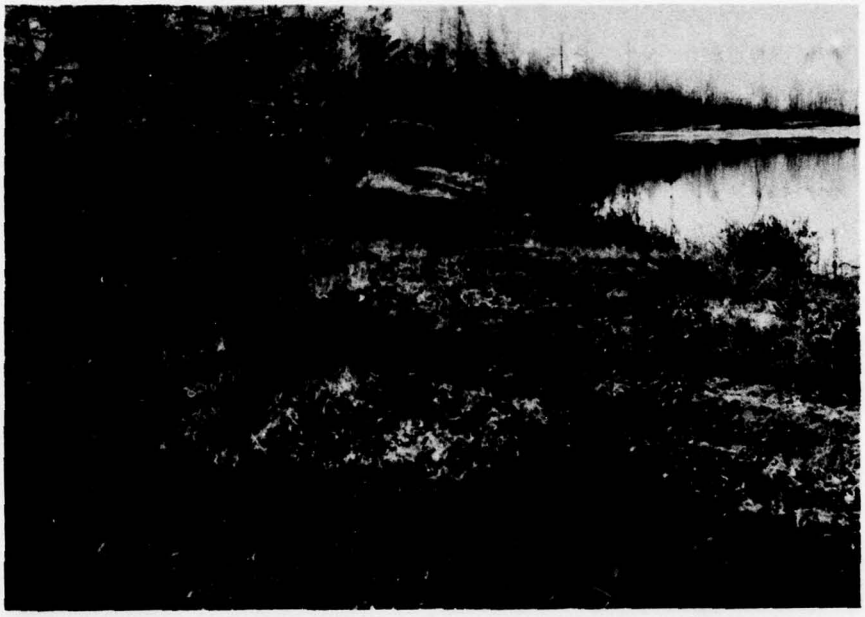
NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

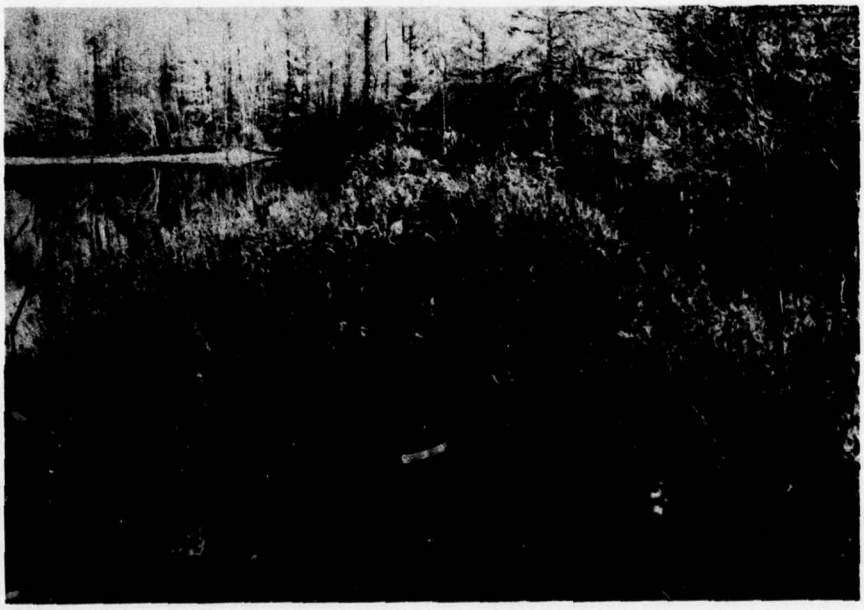
APPENDIX D

PHOTOGRAPHS

MAPLE LAKE DAM



A. Embankment - View from Left Abutment.



B. Embankment - View from Right Abutment.

C. Upstream Slope of Embankment.

D. Downstream Toe.

E. Outlet Works

F. Spillway - Looking Upstream.

G. Spillway Outlet Channel - Looking Downstream.

H. Dike - View from Left Abutment.

SUSQUEHANNA RIVER BASIN

RATTLESNAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID No. PA-00294
DER ID No. 35-42

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1979

APPENDIX E

GEOLOGY

AD-A070 715 GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. MAPLE LAKE DAM (NDI-PA-00294) --ETC(U)
JAN 79 DACW31-79-C-0015

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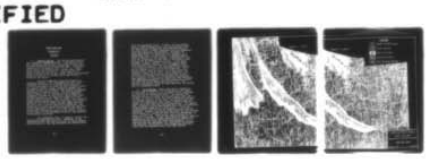

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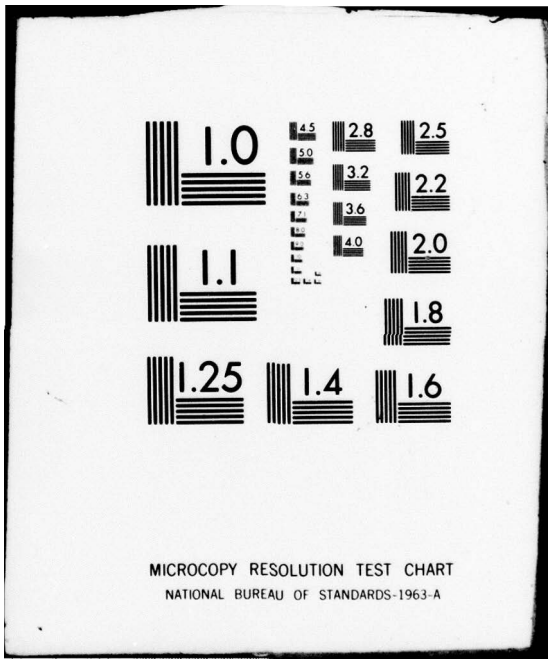
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2.2
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2.8
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4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

MAPLE LAKE DAM

APPENDIX E

GEOLOGY

1. General Geology. The damsite and reservoir are located in Lackawanna County. Lackawanna County was completely covered with ice during the last continental glaciation of Pleistocene time. The general direction of ice movement was S 35°-40° W. Glacial drift covers the entire County, except where subsequent erosion has removed it. Thick deposits of glacial outwash occur in many places along the Lackawanna River, and are 50 to 100 feet thick near Dickson, Scranton, and Moosic.

The only important structural feature in Lackawanna County is the Lackawanna Syncline, which traverses the County in a southwesterly direction. The syncline enters the County at the northeast corner as a narrow shallow trough, gradually deepens and broadens toward the southwest, and reaches its maximum development in Luzerne County. The rock formations exposed range from the post-Pottsville formations (youngest) through the Pottsville, Mauch Chunk shale, Pocono sandstone to the Damascus formation of the Catskill group (oldest). The rim rocks, the Pottsville formation and Pocono sandstone, have dips that rarely exceed 10° to 20° and form a rather simple syncline. The core rocks, the post-Pottsville formations, are folded into a series of minor anticlines and synclines which trend about N 70° E. The rocks in the northwestern and southeastern parts of the County, outside of the limits of the Lackawanna Syncline, are generally horizontally stratified.

The Lackawanna River, in general, follows the axis of the Lackawanna Syncline. Southeast of the Lackawanna River, the rise in terrain is quite gradual and the crests of the high mountains are several miles

from the Lackawanna River. Streams, such as Roaring Brook, Stafford Meadow Brook, and Spring Brook, have cut deep canyons through the mountains and follow a tortuous course to their confluence with the Lackawanna River near Scranton, Pennsylvania. Northwest of Lackawanna River, the mountains rise abruptly to a sharp ridge which in most places is somewhat higher than the country to the northwest. Consequently, most most of the drainage in this part of the County flows westward by way of Tunkhannock Creek. A few small tributary streams, however, such as Leggetts Creek, flow eastward from this area into Lackawanna River. In the area of interest, the Lackawanna River streambed is founded in post-Pottsville formations. Proceeding uphill from the river, the older Pottsville formation, Mauch Chunk shale, Pocono sandstone, and Catskill continental group are encountered in turn. The tributary streams, in flowing down the mountains, have generally cut through or around the hard sandstone and conglomerate members, and have eroded their streambed into the softer shales and glacial till. The Catskill continental group of rocks underlies the greater part of Lackawanna County.

2. Site Geology. Maple Lake Dam is founded in an area that is underlain by the sandstones and shales of the Catskill group to the southeast of the Lackawanna Syncline and the Lackawanna River. The dam was constructed across the outlet of an existing natural lake in 1893, in order to raise the water surface and increase the storage capacity of the lake. The natural lake was created in a depression upon a small plateau which has a higher elevation than the surrounding terrain. The natural pond, originally called Rattlesnake Pond, was the headwaters of Rattlesnake Creek which flowed from it. The rock underlying the plateau area is apparently hard resistant sandstone: whereas, the surface upon which the lake and dam are situated is a relatively deep strata of decomposed red shale, or red clay. There are no rock outcrops in the vicinity of the dam. In the 1914 Inspection Report, made by engineers of the Water Supply Commission of Pennsylvania after discussions with the owners and designers, it is reported that the embankment was constructed of selected clay material resting upon a clay foundation from which loose rock and vegetable matter had been removed.


SCALE: 1" = 6 MILES
CLINTON
NORTH ABINGTON
SCOTT
SOUTH CANAAN
NEWTON
NORTH-MORELAND
MONROE
FRANKLIN
DALLAS
JEFFERSON
SALEM
MADISON
STERLING
SPRING BROOK
COVINGTON
LEHMAN
ROSS
FAIRMOUNT
LEHIGH
CLIFTON
BEAR CREEK
COOLBAUGH
BUCK
TOBYHANNA
SLOCUM
WRIGHT
DORRANCE
HOLLENBACK
TUNKHANNOCK
JACKSON
CHESTNUT


FRANKLIN
JACKSON
MILFORD
BRIDGEWATER
HARFORD
AUBURN
LENOX
CLIFFORD
GREENFIELD
NICHOLSON
CLINTON
NORTH ABINGTON
SCOTT
FALLS
NEWTON
NORTH-MORELAND
MONROE
FRANKLIN